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ABSTRACT

This is one form of three performance checks booklets (A, B, and C) for two texts of Level III of the Intermediate Science Curriculum Study (ISCS). These two texts are In Orbit (IO), and What's Up (WU). The 12 performance checks booklets for Level III are considered one of four major subdivisions of a set of individualized evaluation materials for Level III of the ISCS. This booklet (form A), developed to assess the students' achievement of the objectives of IO and WU of Level III, contains a set of performance checks which are equivalent to the performance checks of the other two forms (B and C). Each performance check has its own code number which indicates the unit number and identifies whether it is based on core material or excursions. Directions for students' use of performance checks are also included. (HM)

INTERMEDIATE SCIENCE CURRICULUM STUDY

ISCS

INDIVIDUALIZED TESTING SYSTEM

Performance Checks

ISCS LEVEL III
IO-WU
FORM A

SILVER BURDETT
GENERAL LEARNING CORPORATION
Morristown, New Jersey · Park Ridge, Ill. · Palo Alto · Dallas · Atlanta

INDIVIDUALIZED TESTING PROGRAM

ALL LEVELS	**Individualizing Objective Testing** (an ITP module) **Evaluating and Reporting Progress** (an ITP module)
LEVEL I	**Performance Objectives**, ISCS Level I **Performance Checks**, ISCS Level I, Forms A, B, and C **Performance Assessment Resources**, ISCS Level I, Parts 1 and 2
LEVEL II	**Performance Objectives**, ISCS Level II **Performance Checks**, ISCS Level II, Forms A, B, and C **Performance Assessment Resources**, ISCS Level II, Parts 1 and 2
LEVEL III	**Performance Objectives**, ISCS Level III **Performance Checks**, ISCS Level III, ES-WB, Forms A, B, and C WYY-IV, Forms A, B, and C IO-WU, Forms A, B, and C WW-CP, Forms A, B, and C **Performance Assessment Resources**, ISCS Level III, ES-WB WYY-IV IO-WU WW-CP

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FOREWORD

To implement an educational approach successfully, one must match the philosophy of evaluation with that of instruction. This is particularly true when individualization is the key element in the educational approach. Yet, as important as it is to achieve this match, the task is by no means simple for the teacher. In fact, without specific resource materials to help him, he is apt to find the task overwhelming. For this reason, ISCS has developed a set of individualized evaluation materials as part of its Individualized Teacher Preparation (ITP) program. These materials are designed to assist teachers in their transition to individualized instruction and to help them tailor their assessment of students' progress to the needs of all their students.

The two modules concerned with evaluation, *Individualizing Objective Testing* and *Evaluating and Reporting Progress*, can be used by small groups of teachers in in-service settings or by individual teachers in a local school environment. Hopefully, they will do more than give each teacher an overview of individualized evaluation. These ITP modules suggest key strategies for achieving both subjective and objective evaluation of each student's progress. And to make it easier for teachers to put such strategies into practice, ISCS has produced the associated booklets entitled *Performance Objectives, Performance Assessment Resources,* and *Performance Checks.* Using these materials, the teacher can objectively assess the student's mastery of the processes, skills, and subject matter of the ISCS program. And the teacher can obtain, at the moment when they are needed, specific suggestions for remedying the student's identified deficiencies.

If you are an ISCS teacher, selective use of these materials will guide you in developing an individualized evaluation program best suited to your own settings and thus further enhance the individualized character of your ISCS program.

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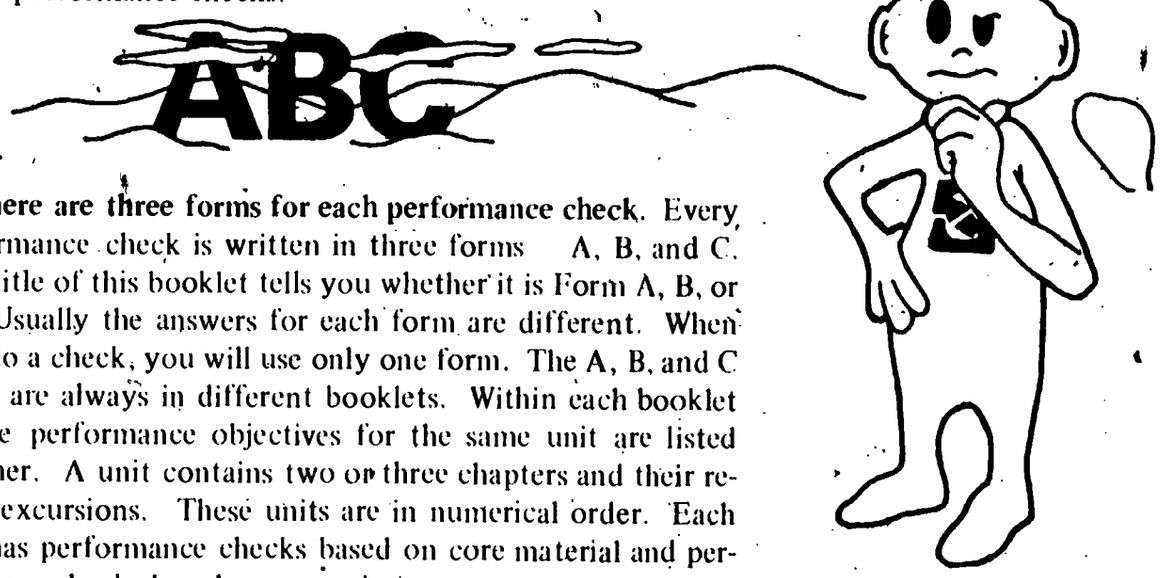
NOTES TO THE STUDENT

Now that you have completed several chapters, excursions, and self-evaluations, you are ready to help your teacher determine how well you are doing. The performance checks in this book will provide your teacher with this information. Then your teacher can help you with things you may not understand and can keep a record of your progress.

Read the next section carefully. It explains some important things about the performance checks in this book, and it gives you specific suggestions for using them.

What You Need To Know about Performance Checks

1. **You do performance checks when you are ready.** Performance checks are somewhat like the questions in the self-evaluations -- you do them when you are ready, not when the whole class is ready.
2. **Your teacher or both of you decide how many you do.** Your teacher or you and your teacher together will decide which ones you should do. You are not expected to do all of the performance checks.



3. **There are three forms for each performance check.** Every performance check is written in three forms A, B, and C. (The title of this booklet tells you whether it is Form A, B, or C.) Usually the answers for each form are different. When you do a check, you will use only one form. The A, B, and C forms are always in different booklets. Within each booklet all the performance objectives for the same unit are listed together. A unit contains two or three chapters and their related excursions. These units are in numerical order. Each unit has performance checks based on core material and performance checks based on excursions.
4. **Each performance check has its own number.** The number is in the outside margin of the page and will look like this: IO-03-Core-17A or WU-01-Exc 2-2-2A. These numbers mean

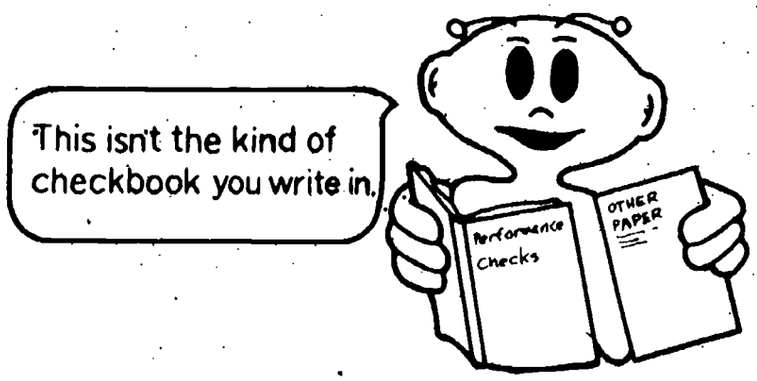
IO	-	03	-	Core	-	17	A	and	WU	-	01	-	Exc	2-2	-	2	A
text		unit		based on core material		check number	form of the check		text		unit		based on excursion material	excursion number		check number	form of the check

5. **Each performance check is separated from the other.** There is a line before each performance check and one after it. Some performance checks have several parts, so do everything called for between the lines. If there is no line at the bottom of a page, the check is continued onto the next page.

6. **Sometimes you will need to use equipment.** If special materials are needed, they will be in boxes labeled with the same number and sometimes the same letter too as the performance check for which you need them.

7. **Some performance checks have two or more answers.** If more than one answer is correct, you must select all the correct choices. In such cases, selecting just one answer is not enough.

8. **Some performance checks have no answers.** Occasionally, you may be asked to do something that is impossible and to explain your answer. If so, say that the task is impossible and explain why.



9. **You share books of performance checks and YOU DO NOT WRITE IN THEM.** Write your answers on other paper. Give the number and form of the performance check for each answer you write. If you are to draw a graph, a chart, or a map, your teacher may provide you with grid paper or a copy of the map or chart.

10. **Your teacher or his assistant will collect and mark your checks.** And sometimes you must ask him to watch or assist you as you do a check.

11. **Sometimes a review procedure will be suggested.** If you can't do a performance check, you may be asked to review a part of the text or a self-evaluation question. You may then be checked on the same material, so be sure you understand the material you review. Get help if you need it.

In Orbit 10

Before you begin, tell your teacher that you are going to do this check. 10

Get a spectroscope, a sheet of white paper, and a 150-watt bulb and receptacle. Pretend that the 150-watt bulb is the sun. Observe the spectrum through your left eye and then through your right eye. Does the spectrum look the same or different through each of your eyes? 01-Core-1A

Get a 150-watt light bulb and socket, and assemble them. Use an ISCS spectroscope to observe the spectrum of the light source. Look at the spectrum on the left side of the spectroscope. 10 01-Core-2A

1. State the color to the left of the yellow area of the left spectrum.
2. State the color to the right of the yellow area of the left spectrum.

State a definition of the term *spectroscope*. 10 01-Core-3A

Describe what a diffraction grating in a spectroscope does to sunlight. 10 01-Core-4A

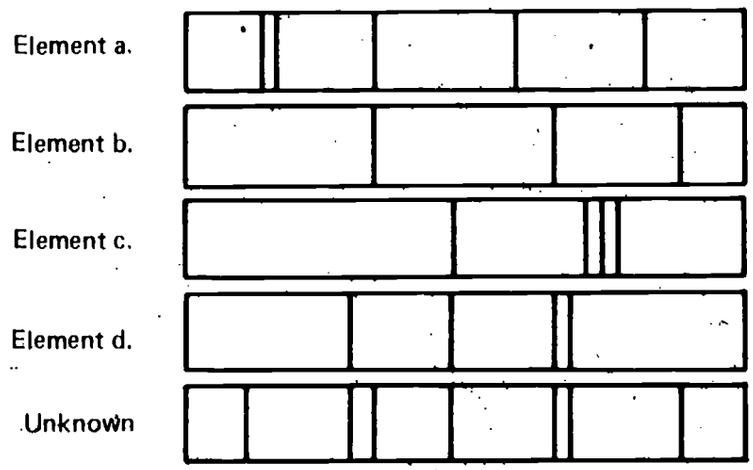
What is a spectrum? 10 01-Core-5A

After the number of each light source below, write the letter of the best description of the spectrum or spectra produced by light from that source. 10 01-Core-6A

Light Source	Description
1. Fluorescent lamp	a. Only a continuous spectrum
2. Crystals containing the element Li (lithium) heated in a flame	b. Only a line spectrum
3. Light bulb	c. Both line and continuous spectra
	d. Neither a line nor a continuous spectrum

Each of the first four spectra below was obtained by heating crystals containing one of four elements. The last spectrum was obtained by heating a solution containing two or more of these elements. Which elements (a, b, c, d) are in the unknown mixture? 10 01-Core-7A

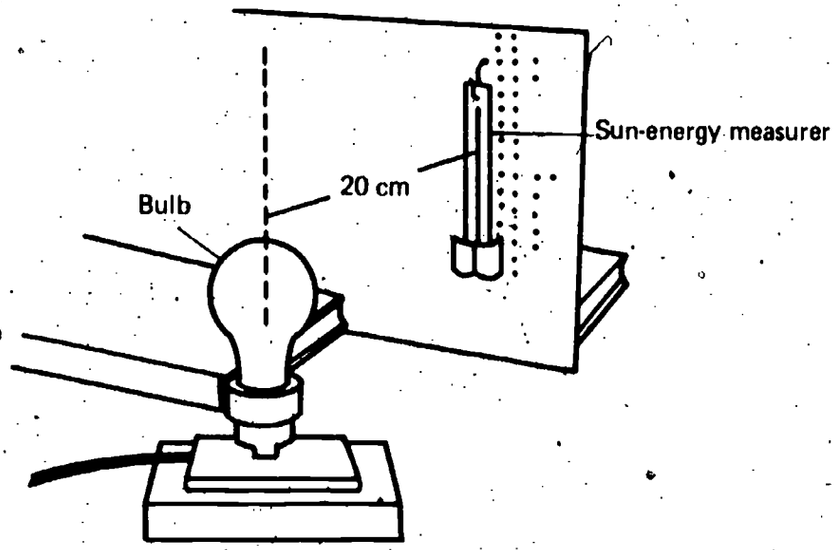
Spectra



IO 01-Core-8A	Suppose that you ran out of burner fuel just after you had viewed the line spectra of solutions of several salts. And then your teacher gave you an unknown mixture of these salts in solution and substituted a different type of burner fuel. Describe the steps you would perform to identify any salts present in your unknown salt solution.
IO 01-Core-9A	You observed the spectrum of the alcohol flame alone before you put the crystals of several chemicals into the burner flame to observe their spectra. Explain why this extra step was necessary.
IO 01-Core-10A	Maria works as a waitress in a restaurant. Some customers have been complaining that their food is cold when they get it. The waitresses pick up the food on trays with silver-colored lids from a warming oven. The problem seems to be that the heating lamps in the warming oven are not heating the food enough. Maria's boss has decided to buy larger light bulbs so that the food will be warmer. Suggest two ways that he could increase the heating effect of the lamps without buying larger bulbs.
IO 01-Core-11A	When an object is placed in direct sunlight, it warms up. What are four variables that affect how much its temperature increases?
IO 01-Core-12A	Suppose two houses are identical except that one has a white roof and the other has a black roof. 1. If you measured the temperature of the air in the attic of each house on a bright summer day, which would be hotter? 2. Explain your answer.
IO 01-Core-13A	When you built your sun-energy measurer, you blackened the copper strip. Explain why that was necessary.

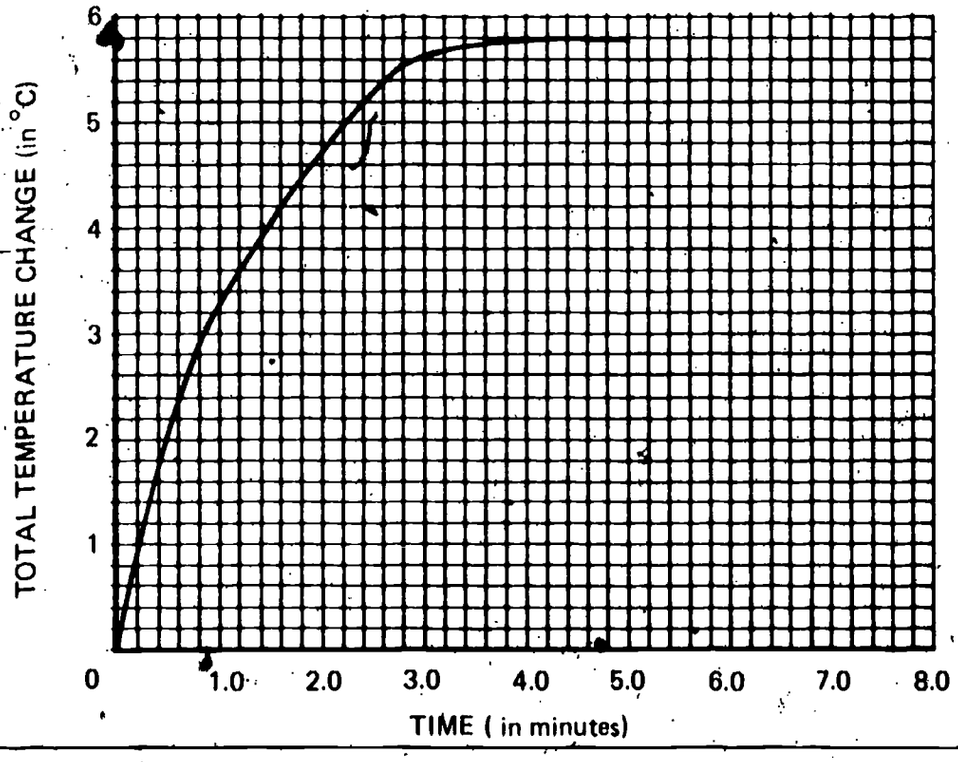
You measured the effect of different wattages of light bulbs on the temperature change of your sun-energy measurer, as shown below. When you did this, you were told to keep the distance between the light sources and the energy measurer the same at all times. You were also told to make sure the amount of time that each bulb shone on the measurer was the same. Why was it important to keep the variables time and distance constant?

IO
01-Core-14A



Frank set up his sun-energy measurer near a 100-watt bulb and measured the temperature change for 5 minutes. He left the apparatus set up with the light bulb on while he drew the following graph of his data. What do you predict will be the total temperature change of his sun-energy measurer 8 minutes after he started collecting his data?

IO
01-Core-15A

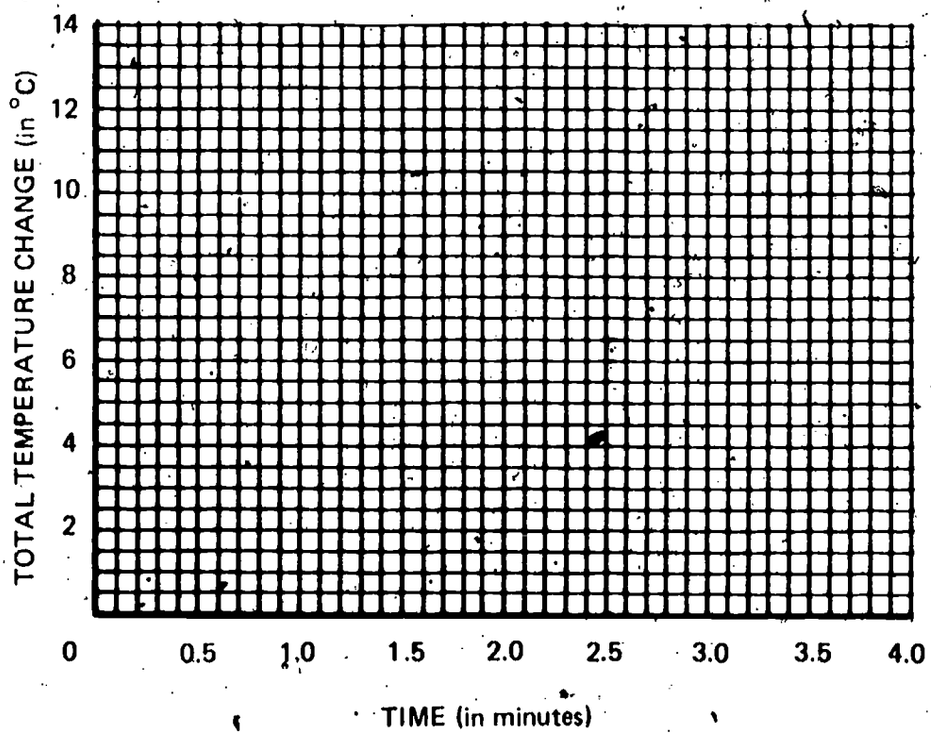


Before you begin this check ask your teacher for graph paper or a labeled grid like the one shown below.

Henry placed his sun-energy measurer near a light source and recorded its temperature every 30 seconds. His data are shown below.

TIME (in min)	TEMPERATURE (in °C)	TOTAL TEMPERATURE CHANGE (in °C)
0.0	20.4	0.0
0.5	22.8	2.4
1.0	25.5	5.1
1.5	27.6	7.2
2.0	28.8	8.4
2.5	30.0	9.6
3.0	30.7	10.3
3.5	31.0	10.6
4.0	31.1	10.7

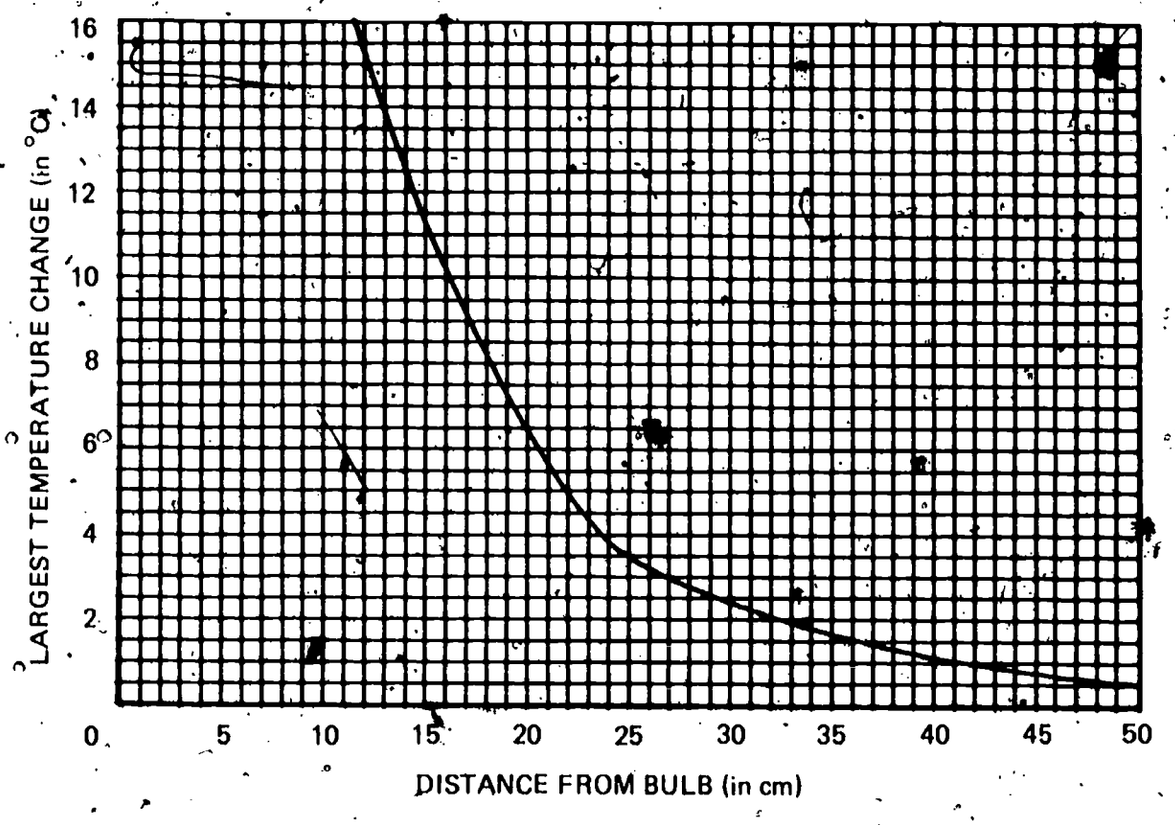
Graph Henry's measurements of the temperature change and the time on the grid.



Jason bought a new reading lamp with a plastic shade. When he got it home, he noticed a sticker on it that read, "WARNING: BULBS OF MORE THAN 40 WATTS ARE NOT TO BE USED IN THIS LAMP." He wondered why he shouldn't use a bulb of more than 40 watts, since the wiring was the same as on the other lamps in the house. IO 01-Core-17A

1. Explain why the warning sticker is on the lamp.
2. Predict what might happen if Jason used a 100-watt bulb in this lamp.

Maria put a sun-energy measurer in direct sunlight. She found that the largest temperature change of her sun-energy measurer was 12.5°C. She then measured the largest temperature changes of her measurer at different distances from a 150-watt bulb. She used her data to plot the graph shown below. IO 01-Core-18A



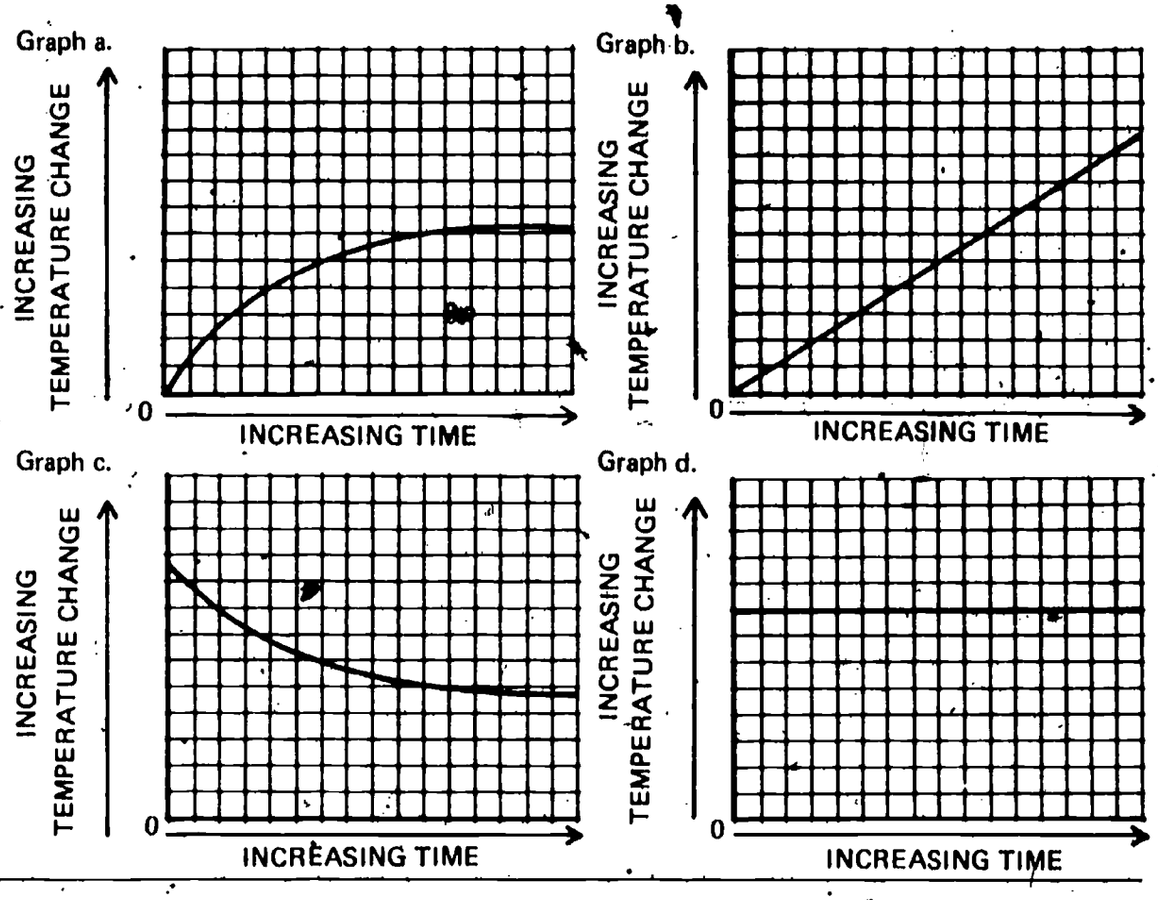
At what distance from the 150-watt bulb did her sun-energy measurer receive the same amount of energy as it did from the sun when it was placed in direct sunlight?

Chris built a small chicken brooder to keep some baby chicks warm. It used a 25-watt bulb to produce enough heat to keep the chicks warm. He is planning to build a larger brooder to raise more chickens. In the new brooder, the bulb will be twice as far away from the baby chicks. Select the wattage of the light bulb he should use in order to produce nearly the same heating effect as in the smaller brooder. IO 01-Core-19A

a. 10 watts
b. 25 watts
c. 100 watts
d. 12½ watts
e. 50 watts

10
01-Core-20A

Ashly read the temperature of her sun-energy measurer in the shade. Then she put the measurer in direct sunlight. Every 30 seconds she read the temperature. Later she drew a graph showing the temperature rise of her sun-energy measurer. Which of the graphs below best shows what her graph would look like?



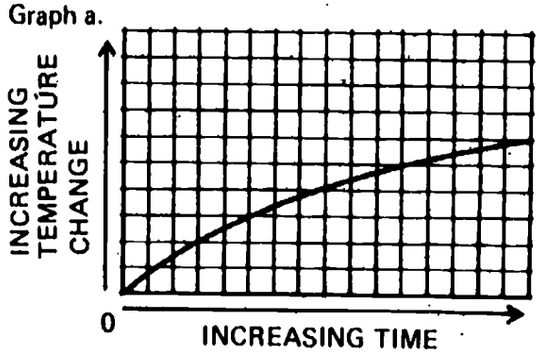
Martha measured the temperature changes in her sun-energy measurer when she placed it 20 cm from a 50-watt light bulb. She then changed to a 75-watt bulb and measured the temperature changes again. She also made measurements for 100-watt and 150-watt bulbs. On your answer sheet, match the letters of the graphs she drew with the numbers of the light bulbs she used.

IO
01-Core-21A

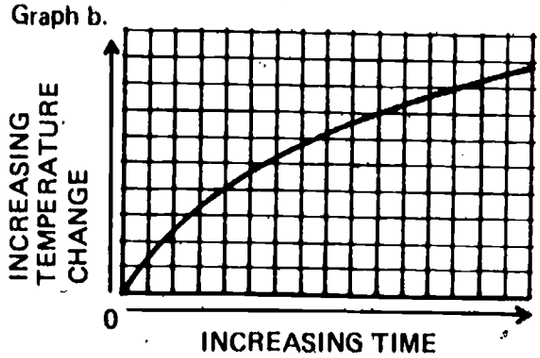
Bulbs
1. 50 watt
2. 75 watt
3. 100 watt
4. 150 watt

Graphs

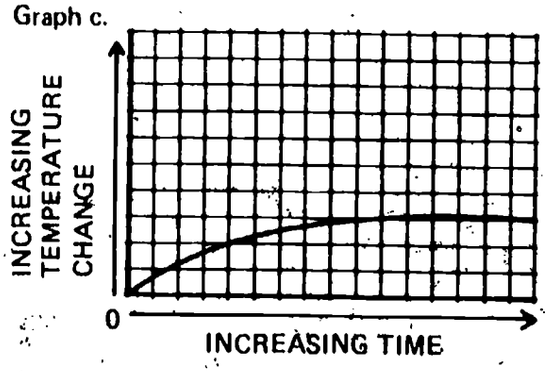
Graph a.



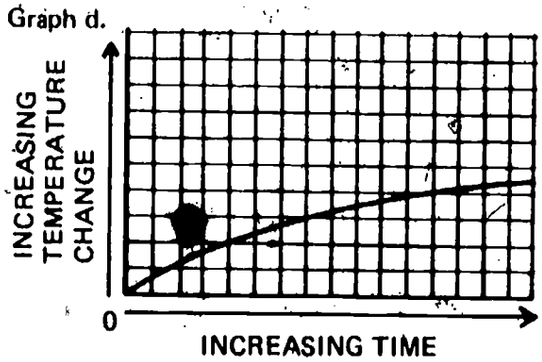
Graph b.



Graph c.

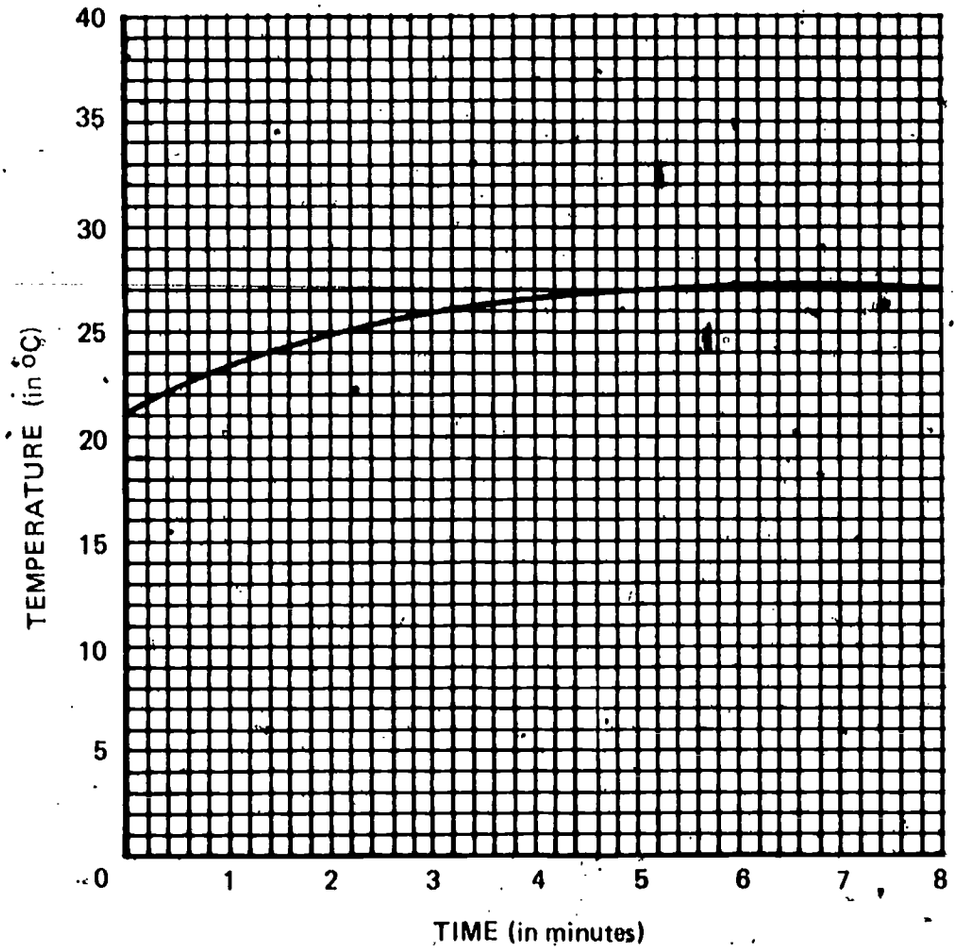


Graph d.



10
01-Core-22A

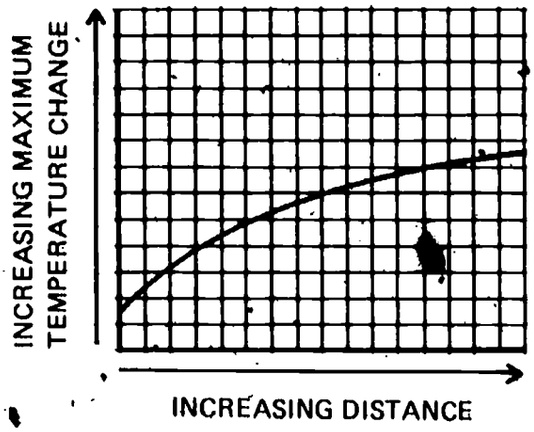
Terry put his sun-energy measurer 30 cm from a light bulb and read its temperature. He then read it every 30 seconds. He plotted his temperature data on the graph shown below.



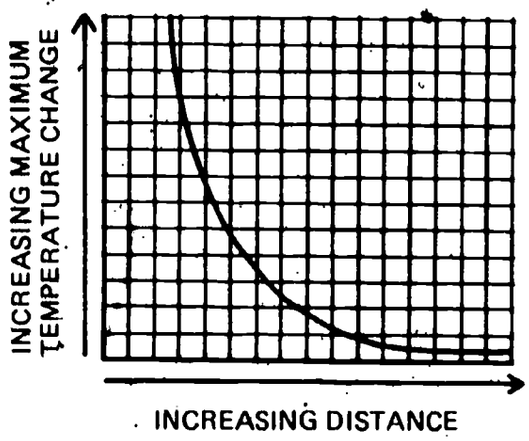
What was the total temperature change of Terry's sun-energy measurer?

Select the graph that best shows how the temperature change of a sun-energy measurer varies as you increase its distance from the light source. IO 01-Core-23A

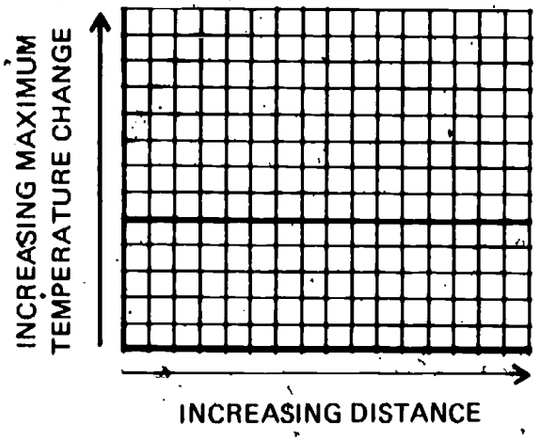
Graph a.



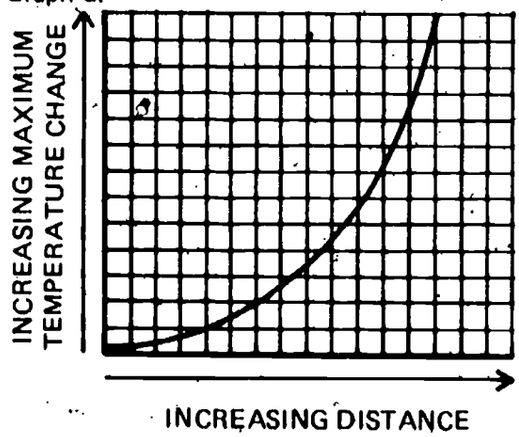
Graph b.



Graph c.



Graph d.



Your teacher will observe you for this check when he can. IO 01-Core-24A

Your teacher will observe you for this check when he can. IO 01-Core-25A

Your teacher will observe you for this check when he can. IO 01-Core-26A

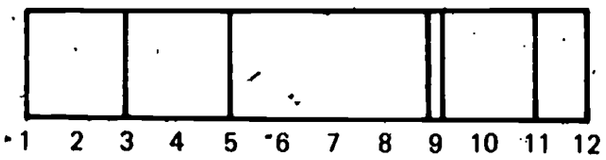
Your teacher will observe you for this check when he can. IO 01-Core-27A

Your teacher will observe you for this check when he can. IO 01-Core-28A

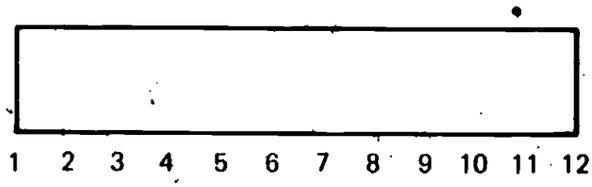
IO
01-Exc 1-1-1A

Sally drew the diagram shown below of the bright-line spectrum of element X.

Element X
Bright-line spectrum



Copy the diagram below onto your answer sheet, and draw the spectrum that you would expect to see if you observed the dark Fraunhofer lines, or dark-line spectrum, of element X.



IO
01-Exc 2-1-1A

George built a device that he then placed in a sealed, metal box. There is no way to get energy into the box. The box has an electrical outlet on the side and a motor has been plugged into it. The motor has been working for more than a week.

1. Describe what is happening inside the box to operate the motor.
2. Can George's device continue to make the motor work forever?
3. Explain your answer to part 2.

IO
01-Exc 2-1-2A

How do you calculate the amount of work done to move a chair across a room?

IO
01-Exc 2-1-3A

The term *conservation of energy* is frequently used by scientists. Explain the meaning of the term.

IO
01-Exc 2-1-4A

Energy can exist in many different forms. List three different forms of energy.

You often use a ruler to measure distances directly. However, there are many reasons why distances must sometimes be measured by indirect methods, using a device such as a range finder which measures angles. These measured angles are then changed into distance measurements. Think of two such reasons. Then for each of them describe a situation in which making an indirect measurement of distance would be better than trying to measure the distance directly. **IO 02-Core-1A**

Explain briefly the principle on which the range finder works when you use it to measure distances. **IO 02-Core-2A**

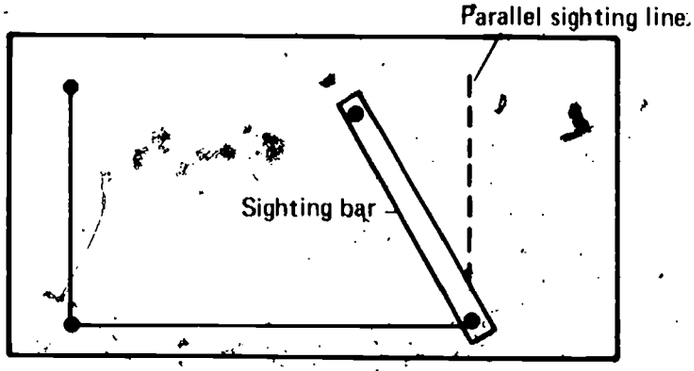
You used calibrated measuring devices (measuring devices with scales) in your lab activities. Why is it necessary to use calibrated rather than uncalibrated measuring devices? **IO 02-Core-3A**

Get the ISCS range finder labeled IO-02-Core-4, and find the distance between the two points which your teacher names for you. **IO 02-Core-4A**

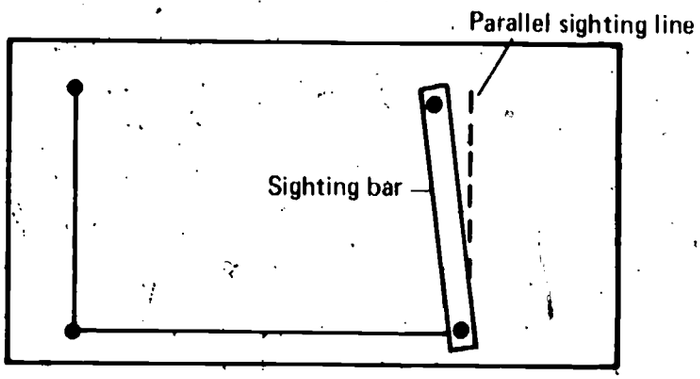
1. Which of the range finders diagramed below is being used to measure the larger distance?
2. Explain the reason for your choice.

IO 02-Core-5A

Range finder a.



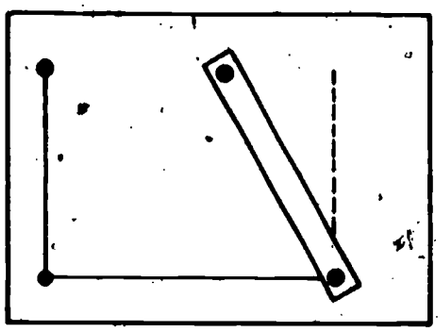
Range finder b.



IO
02-Core-6A

Suppose you are asked to measure the distance to a tree on the other side of a wide river. You are to use one of the range finders shown below.

Range finder a.



Range finder b.

1. Which of the range finders could measure the large distance more accurately?
2. Explain your choice.

IO
02-Core-7A

What are the two variables that limit the greatest distance you can measure accurately with a range finder?

IO
02-Core-8A

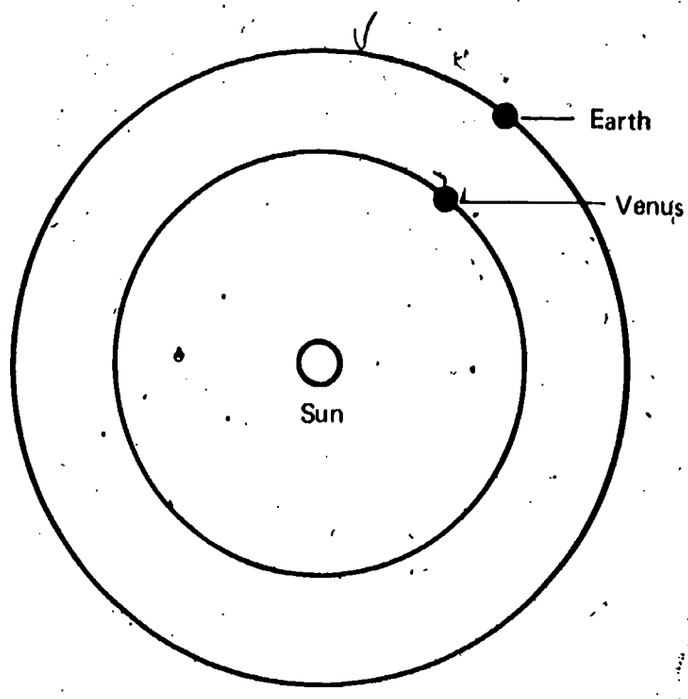
Ask your teacher to watch you do this check. Place a 150-watt light at one side of your work area. Get a range finder from the supply area, and place it at the other end of your work area. Read the instructions for Activities 3-7 and 3-8 on page 28 of *In Orbit*. Pretend that the bright light is the sun, and go through the steps of the activities as though you were measuring the distance to the sun.

IO
02-Core-9A

Why can't the distance from the earth to Polaris (the North Star) be measured by a range finder like the one you made in class?

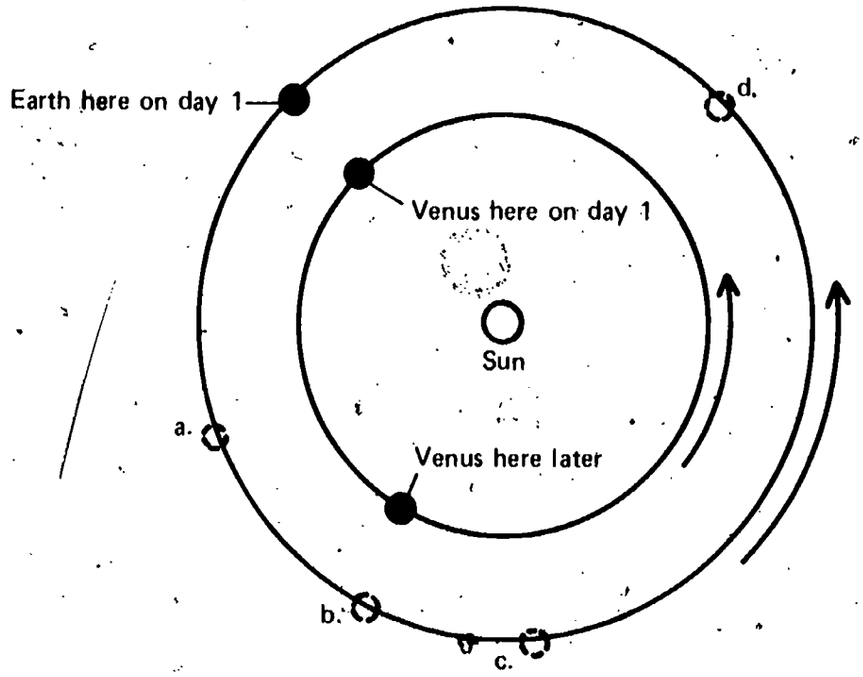
You drew a model of the Earth-sun-Venus system similar to the one shown below. Like all scientific models, it is based on certain assumptions. What were four assumptions you made in drawing this model?

IO
02-Core-10A



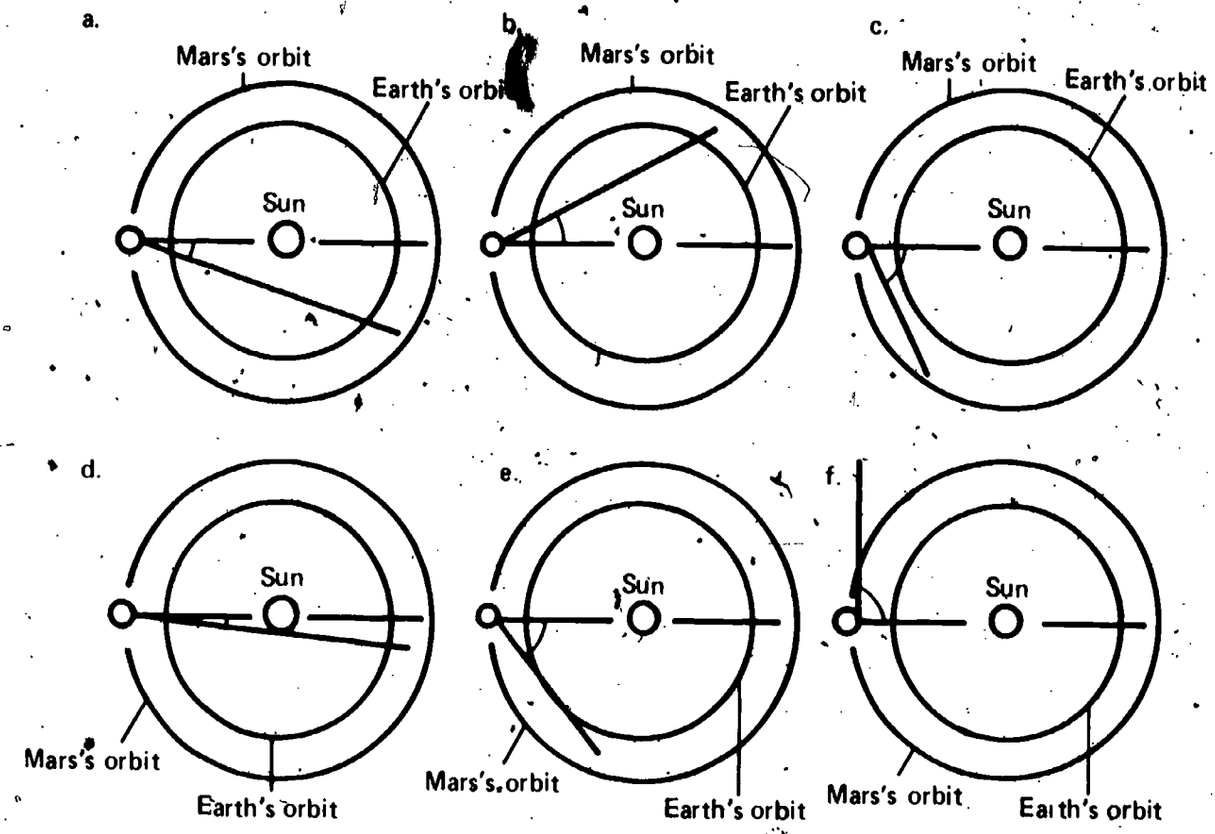
The diagram below shows the positions of Venus and Earth on the same day. It also shows the position of Venus a few months later. Select the letter of the approximate location of Earth at that later time.

IO
02-Core-11A



10
02-Core-12A

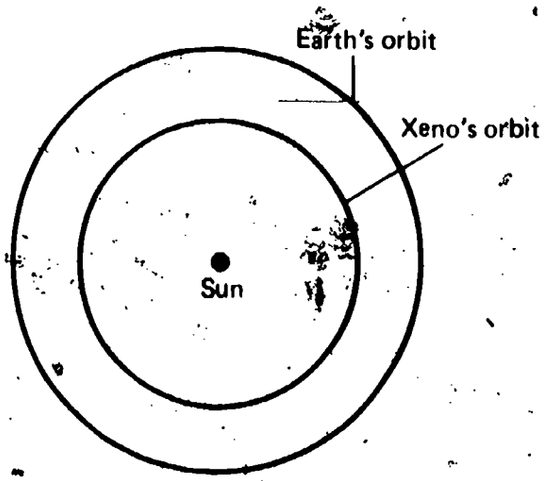
Select the diagram below that shows the greatest possible ME-MS angle.



10
02-Core-13A

Get a drawing compass and a ruler, and copy the diagram below.

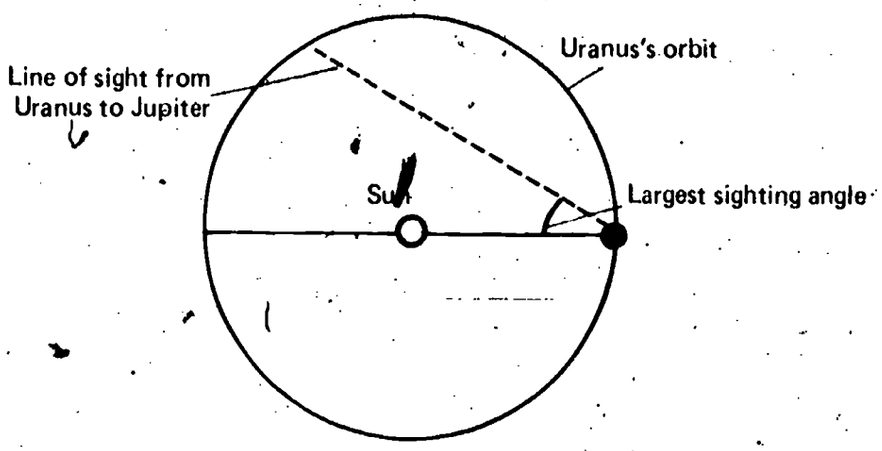
Suppose that planet Xeno were discovered between the Earth and the sun. A model of the Earth-sun-Xeno system is shown in the diagram.



On your copy of the diagram, draw in the lines of sight from Earth to Xeno and from Earth to the sun that would give the largest ES-EX angle.

Get a drawing compass. Suppose you were an ISCS student on the planet Uranus. You have just drawn a model of the sun-Uranus-Jupiter system. The sighting line from Uranus to Jupiter, which is shown below, is the line which makes the largest US-UJ angle. Copy the model below onto your answer sheet, and complete the model by drawing a circle to represent the orbit of Jupiter.

IO
02-Core-14A

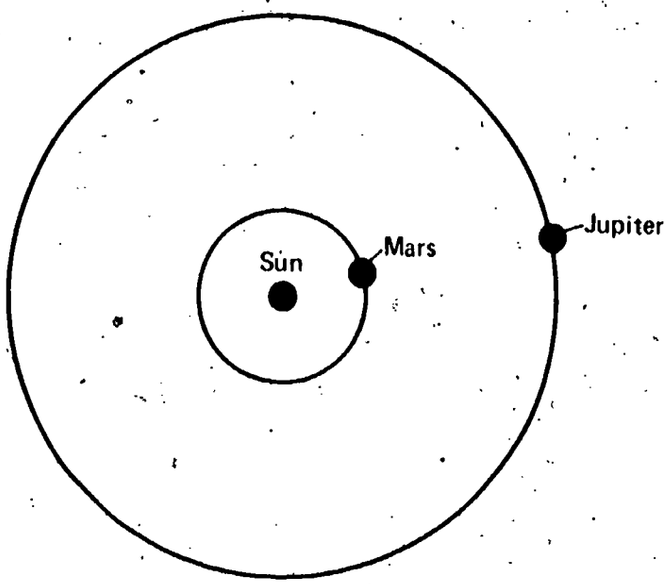


Suppose that a colony of men lived on Mars, which is farther from the sun than Venus. They have measured the maximum angle between Venus, Mars, and the sun to be 33°. Draw a scale diagram of the orbits of Venus and Mars. Use a circle with a radius of 9 cm to represent the orbit of Mars. You may use a protractor, a drawing compass, and a metric ruler.

IO
02-Core-15A

The scale diagram shown below represents the orbits of Mars and Jupiter. The minimum distance between Mars and Jupiter is 342 million miles.

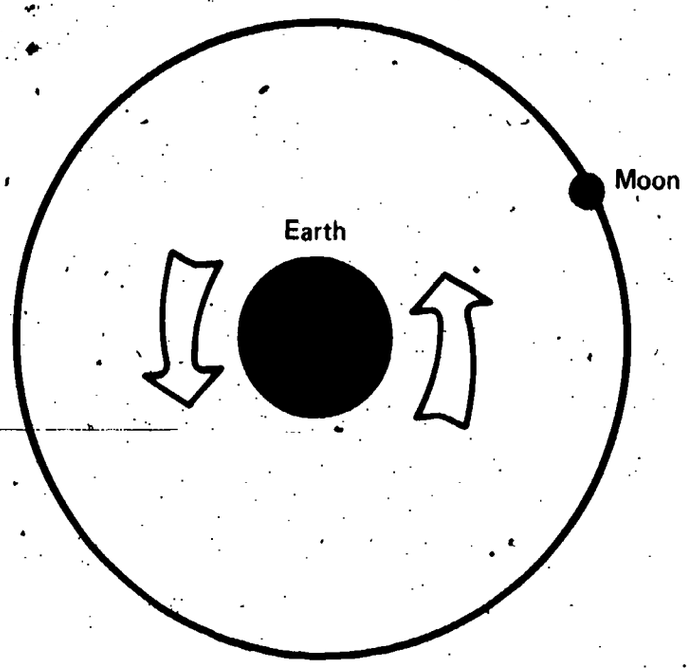
IO
02-Core-16A



What is the radius of Jupiter's orbit? State your answer in millions of miles.

IO
02-Exc 3-1-1A

When you found the moon's diameter, you made use of several assumptions about the earth-moon system shown below. What were two of those assumptions?

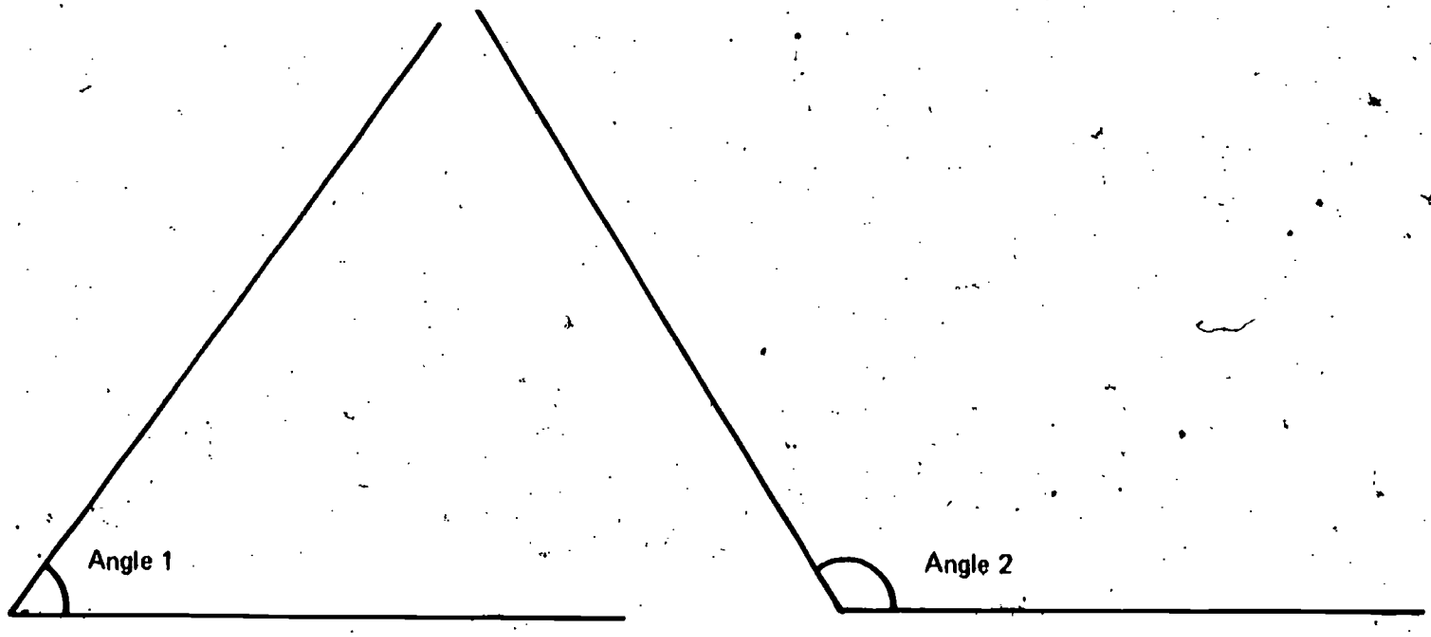


IO
02-Exc 4-1-1A

Explain briefly the process by which radar measures the distance to an object.

IO
02-Exc 4-2-1A

Using a protractor, measure each of the angles shown below.

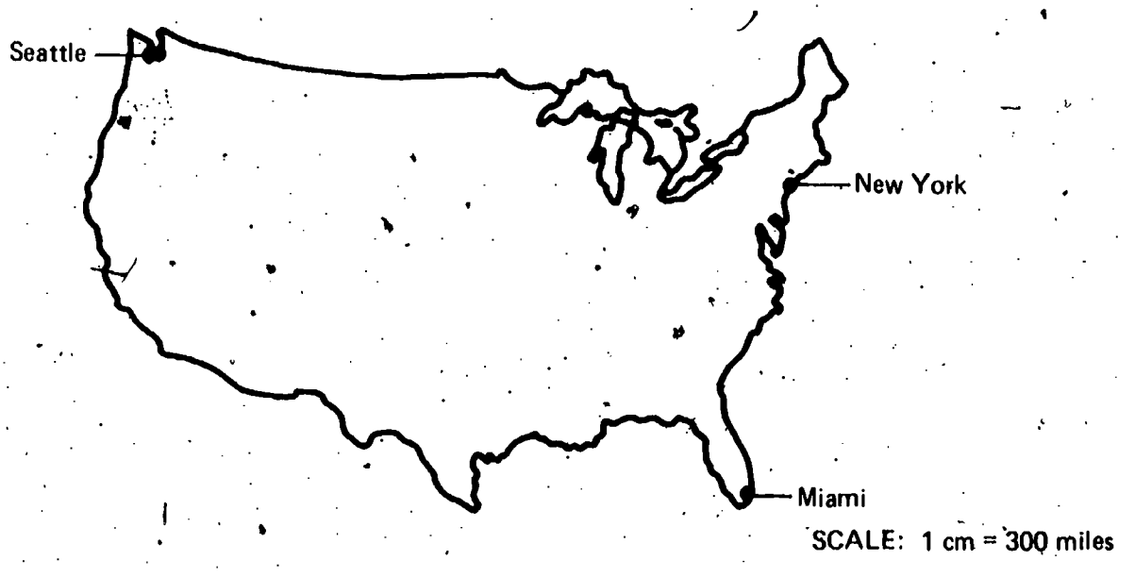


IO
02-Exc 4-2-2A

Use your protractor to construct angles of 37° and 124°.

Use the scale drawing below to answer the questions that follow.

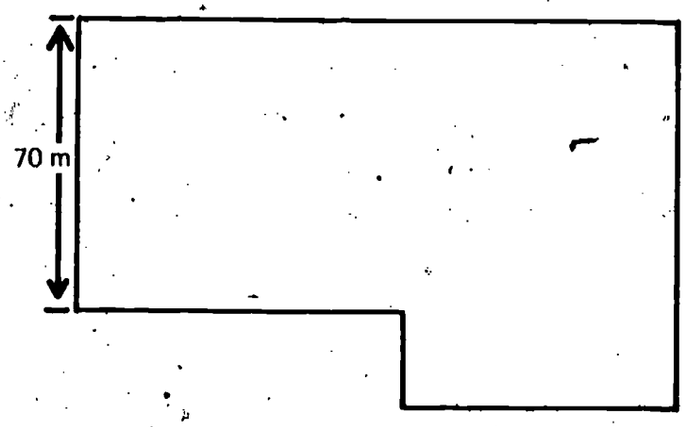
IO
02-Exc 4-3-1A



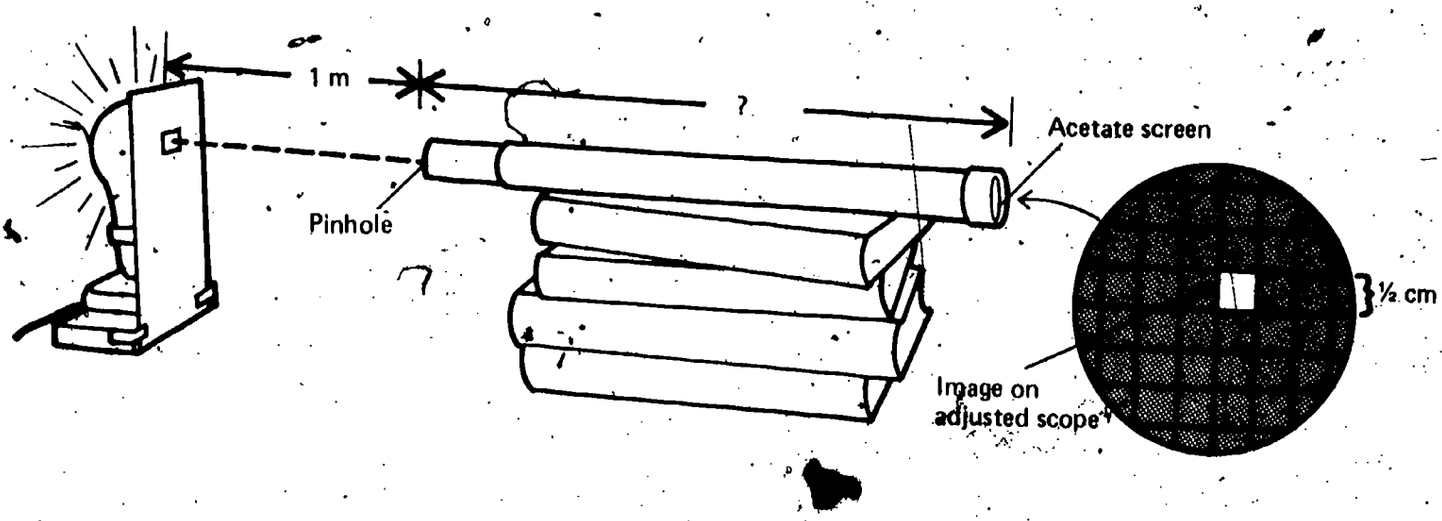
1. What is the actual distance from New York to Seattle?
2. What is the actual distance from Miami to Seattle?

The drawing below is a scaled diagram of a warehouse. What is the scale of this diagram?

IO
02-Exc 4-4-1A



10
03-Core-1A



Get a piece of cardboard with a 1-cm^2 hole in it, a sighting scope, and a 150-watt light bulb and socket. In a darkened area of the room, set up the apparatus as shown in the diagram above. Position the sighting scope so that the pinhole is 1 meter from the cardboard with the 1-cm^2 opening. Adjust the scope so that the image on the acetate screen is ½ cm across. Now measure and record the distance between the pinhole and the acetate screen.

Frank was reading a science book and noticed that in one chapter it gave a measurement for the diameter of the sun. He showed the page to his brother and said that the book must be wrong. No one has ever been to the sun to measure its size, and if someone ever did try to get close enough to measure it, he would get fried to a crisp.

10
03-Core-2A

1. Do you agree with Frank that it is impossible to measure the size of the sun?
2. Explain your answer.

Your teacher has set up for you a light bulb and a piece of cardboard with a hole in it. Get a meterstick and a sighting scope from the supply area. Use the sighting scope, the meterstick, and the formula below to calculate the distance across the hole in the cardboard.

10
03-Core-3A

$$\text{distance across the hole} = \frac{\text{distance from object to pinhole}}{\text{distance from pinhole to screen}} \times \text{distance across image}$$

10
03-Core-4A

Skug is an ISCS student on Venus. He wants to measure the distance across the sun, using a sighting scope. Here is the information he has collected.

Sun to Venus distance = 67 million miles
Distance across sun's image on sighting scope = ½ cm
Distance from pinhole to screen = 39 cm

Use the formula shown below to calculate the distance across the sun.

$$\text{Distance across sun} = \frac{\text{distance from sun to planet X distance across image}}{\text{distance from pinhole to screen}}$$

10
03-Core-5A

A day on planet Xeno is 30 hours long. If you measured the number of degrees that the sun appears to move in one hour on Xeno, what would your measurement be?

10
03-Core-6A

Why is it hard to prove that the earth turns and that the sun does not travel around the earth each day?

10
03-Core-7A

A day on the planet Mars lasts 25 hours, not 24 as on earth. Assume that the sun's path is directly over Mars's equator on the day in question.

1. How many degrees does Mars turn from sunrise until the sun is most nearly overhead?
2. How many degrees does Mars turn from sunrise to sunset?

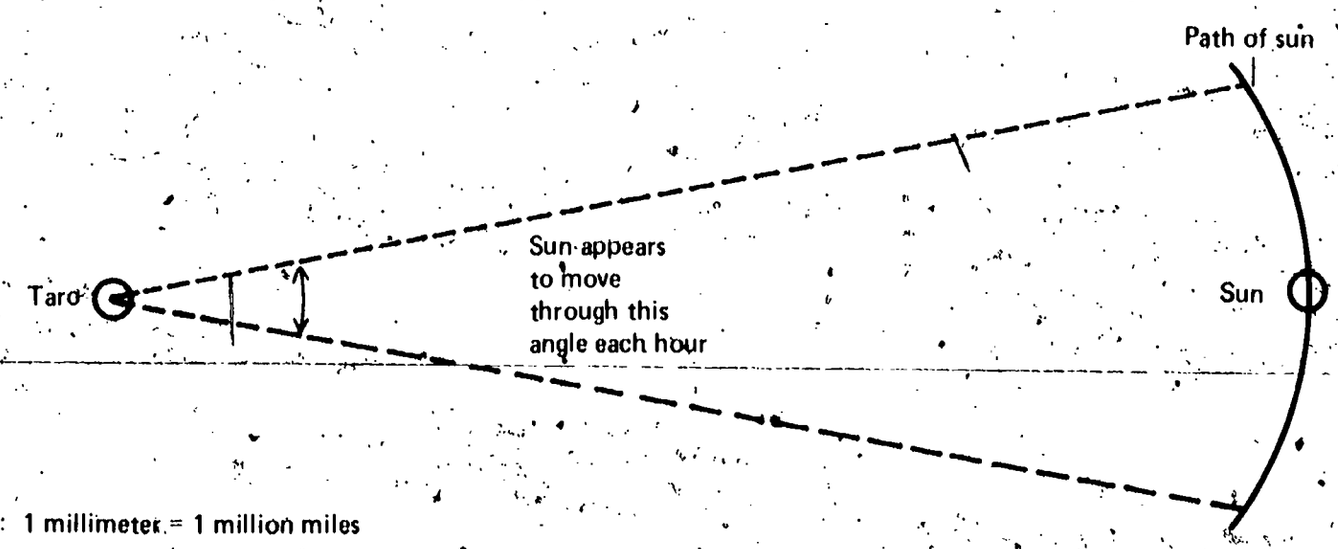
10
03-Core-8A

Almost every fourth year is a leap year, and February has 29 days instead of 28.

1. Why is the extra day added to most fourth years?
2. What is the purpose of leap year?

10
03-Core-9A

Suppose you are a student on the planet Taro. You are trying to decide whether Taro turns on its axis each day or the sun makes one complete trip around Taro each day. You drew the scale diagram shown below of the sun and Taro. The angle through which the sun appears to move each hour is shown on the diagram.

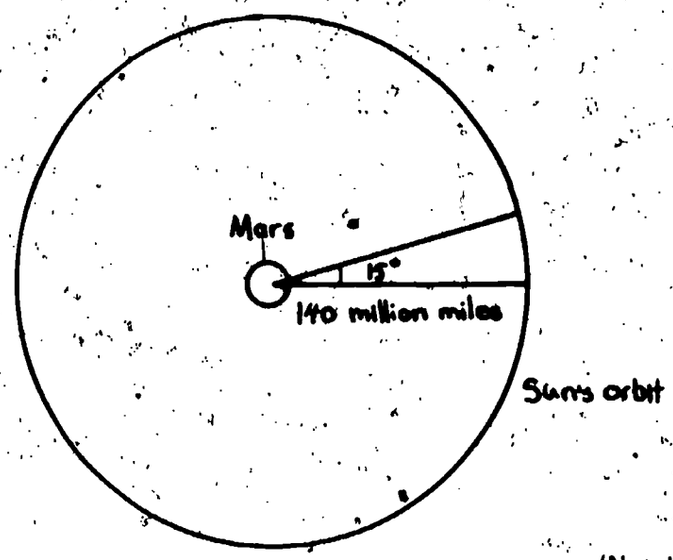


Scale: 1 millimeter = 1 million miles

Use this scale diagram to find the speed at which the sun would have to travel (in miles per hour) to make one complete trip around Taro each day.

Suppose you lived on Mars and wanted to find out how fast the sun would travel if it made one trip around Mars each day. You have made the following measurements and drawn the sketch below. IO 03-Core-10A

The distance from the sun to Mars is 140 million miles.
The apparent motion of the sun across the sky is 15° per hour.



(Not drawn to scale)

How fast would the sun have to travel in miles per hour to make one trip around Mars each day? (Hint: Constructing a scale diagram with a compass, protractor, and ruler will be helpful.)

Why is it unlikely that the sun travels around the earth each day? IO 03-Core-11A

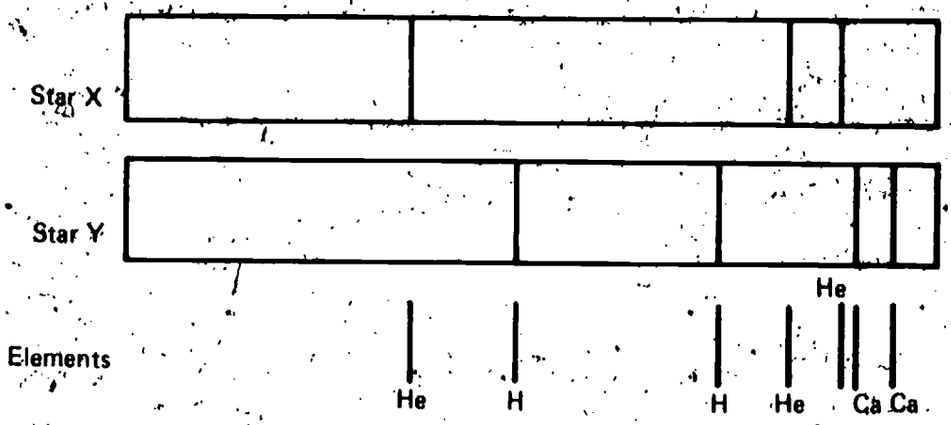
Explain briefly why the earth has been divided into time zones. IO 03-Core-12A

Henry bought a heating device that uses a 125-watt bulb to keep fried eggs at a certain temperature. Joe wants to build a device of the same type, but one in which the bulb will be twice as far from the eggs as in Henry's. What wattage light bulb would Joe need to keep his eggs at the same temperature as Henry's? IO 03-Core-13A

Mario finds that a 75-watt bulb placed 20 cm from his sun-energy measurer has the same heating effect as a larger bulb placed 320 cm from the measurer. Find the wattage of the larger bulb. Show all your work. IO 03-Core-14A

10
03-Core-15A

Suppose that the light from two different stars, X and Y, is passed through a spectroscope. Their spectra and the spectral lines of some common elements are also given below. Use the spectra and the data in the table below to say as much as you can about the two stars. You should include a comparison of their composition and power (wattage) in your answer.



STAR	DISTANCE FROM EARTH	TEMPERATURE RISE IN SUN-ENERGY MEASURER
X	30 light-years away	13.6°C
Y	15 light-years away	6.8°C

10
03-Core-16A

The term *transit* is often used when talking about planets. What is the definition for the term *transit* when referring to the sun and its planets?

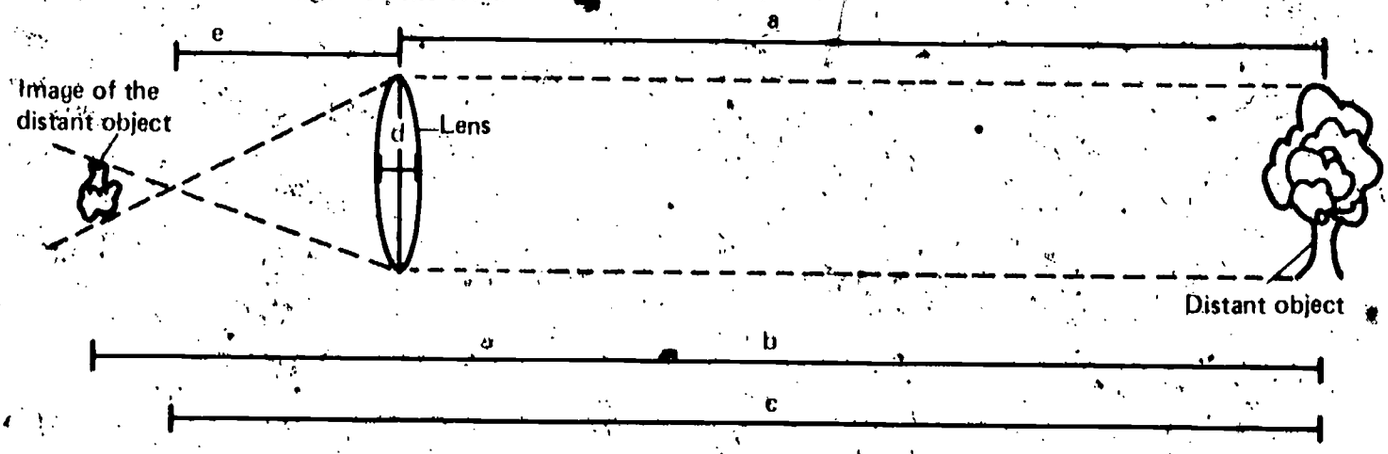
10
03-Exc 5-1-1A

Frances made a telescope. The object lens of her telescope has a focal length of 27 cm. The eyepiece lens has a focal length of 3 cm. Use the formula given below to calculate the power of the telescope.

$$\text{Power} = \frac{\text{focal length of object lens}}{\text{focal length of eyepiece}}$$

10
03-Exc 5-1-2A

Select the letter of that line on the diagram below which best represents the focal length of the lens.



Get the lens marked IO-03-Exc 5-1-3 and a meterstick, masking tape, and a piece of cardboard, 15 cm square, with a white surface. With your text open to page 93, follow the directions in Activity 1 and measure the focal length of the lens. IO 03-Exc 5-1-3A

Two lenses with focal lengths 4 cm and 25 cm are to be used to make a telescope to magnify the distant object shown below. IO 03-Exc 5-1-4A

1. What should be the focal length of the lens at B?
2. What should be the focal length of the lens at A?
3. Approximately how far apart will the lenses have to be placed to get the maximum magnification?

Human eye

B

A

Distant object

For many thousands of years people did not have calendars. Explain why people began to develop and use calendars. IO 03-Exc 6-1-1A

Throughout the past several thousand years many different calendars have been devised and rejected. Explain why these older calendars were rejected. IO 03-Exc 6-1-2A

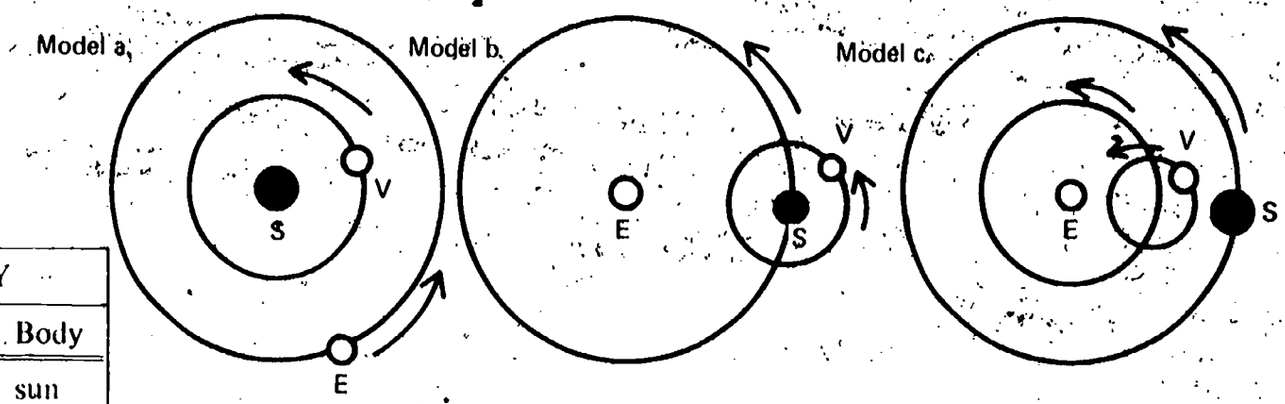
John has found several history books that say that the Pilgrims landed at Plymouth Rock on December 21, 1620. Other books report December 11, 1620, as the landing date. Explain why two different dates are listed for the same event. IO 03-Exc 6-1-3A

Galileo decided to accept the Copernican model of the solar system and reject the Ptolemaic model. Select the best reason that Galileo could have had for accepting one model and rejecting the other. IO 03-Exc 6-2-1A

a. The Copernican model had been thought up more recently.
b. All the other scientists believed in the Copernican model.
c. Copernicus's model was more logical, and it was just common sense to reject Ptolemy's model.
d. Copernicus's model agreed more closely with Galileo's observations.
e. Copernicus was an important official in the church.

IO
03-Exc 6-2-2A

1. Identify the model shown below which represents Ptolemy's model of the solar system.
2. Identify the model below which represents Copernicus's model of the solar system.



KEY	
Symbol	Body
S	sun
V	Venus
E	earth

IO
03-Exc 7-1-1A

Work is one of the two variables required to calculate power. Name the other variable.

IO
03-Exc 7-1-2A

The city has just purchased an electrical generator which has more power than the one it was using before.

What is the meaning of the term *power* as used in the sentence above?

IO
03-Exc 7-1-3A

In Excursion 7-1, the terms *power* and *powerful* were defined as they are used by scientists. A heavy-equipment manufacturer advertises his new line of bulldozers as more powerful than last year's models.

1. Is this manufacturer using the word *powerful* in the same way a scientist does?
2. Explain your answer.

IO
03-Exc 7-2-1A

Kate found that her sun-energy measurer warmed up 12°C when it was held 25 cm from a 100-watt bulb. Use the method of squares to calculate the power of the light bulb that would have the same heating effect at a distance of 275 cm.

IO
03-Exc 7-2-2A

Square each of the following numbers.

1. 7
2. 9
3. 16

What's Up? WU

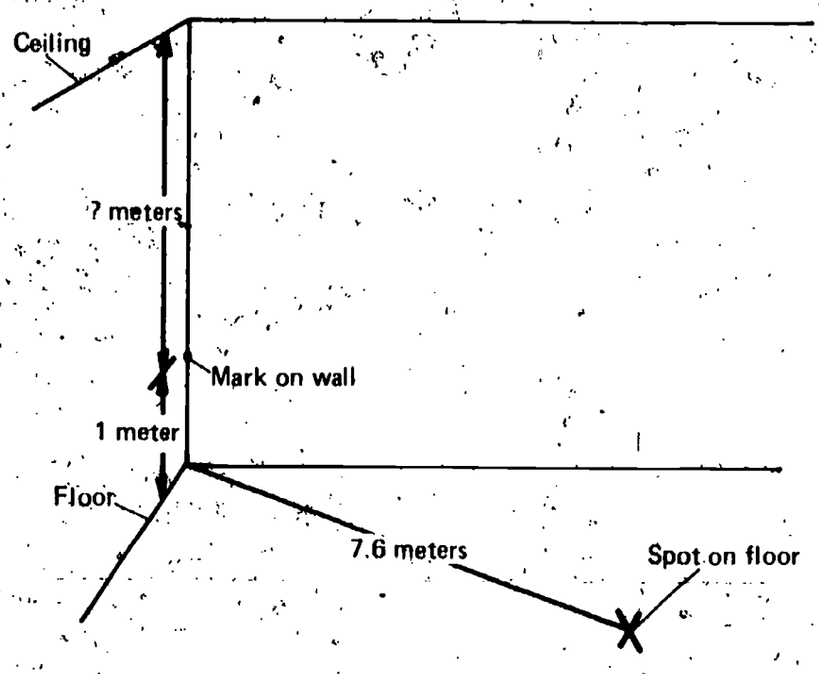
Get a water rocket with its pump and funnel, a meterstick, a 100-ml beaker, and some water. Tell your teacher you are ready to be observed. With the observer, go to the place outside designated by your teacher, and launch the rocket, using 50 ml of water.

WU 01-Core-1A

Get a quadrant and a meterstick. Study the diagram below. Station yourself at the spot on your classroom floor which is 7.6 meters from a corner designated by your teacher. Use the quadrant and the table below to measure the difference in height between the ceiling of your classroom and the mark 1 meter off the floor.

WU 01-Core-2A

HEIGHT CONVERTER FOR OBSERVER AT 7.6 METERS									
Angle	0°	5°	10°	15°	20°	25°	30°	35°	40°
Height (in m)	0	0.7	1.3	2.1	2.8	3.6	4.4	5.3	6.4



Rather than measuring the height of the rocket's flight directly, you made an indirect measurement of height. To do this, you estimated the angle size. What are the advantages of finding the height indirectly?

WU 01-Core-3A

WU 01-Core-4A

Use the table below to answer the question that follows.

HEIGHT CONVERTER FOR OBSERVER AT 25 METERS									
Angle	0°	5°	10°	15°	20°	25°	30°	35°	40°
Height (in m)	0	2.2	4.4	6.9	9.1	11.7	14.4	17.5	21.0
Angle	45°	50°	55°	60°	65°	70°	75°	80°	85°
Height (in m)	25.0	29.8	35.7	43.3	53.6	68.7	93.3	141.8	285.8

Suppose you were an observer standing 25 meters from the site of a rocket launch. When the rocket was at its maximum height, you measured the angle to be 65°. What was the maximum height to which the rocket climbed?

WU 01-Core-5A

When you and your team members measured the maximum heights of the rocket's flights, there were two observers. Why were two observers used to make each of the measurements rather than just one?

WU 01-Core-6A

Write an operational definition for *performance* for a water rocket, based upon your activity with the quadrant.

WU 01-Core-7A

You designed an experiment to determine the effects of changing the amount of air and water in a rocket. You were told to change only one of those variables at a time. Why was this important?

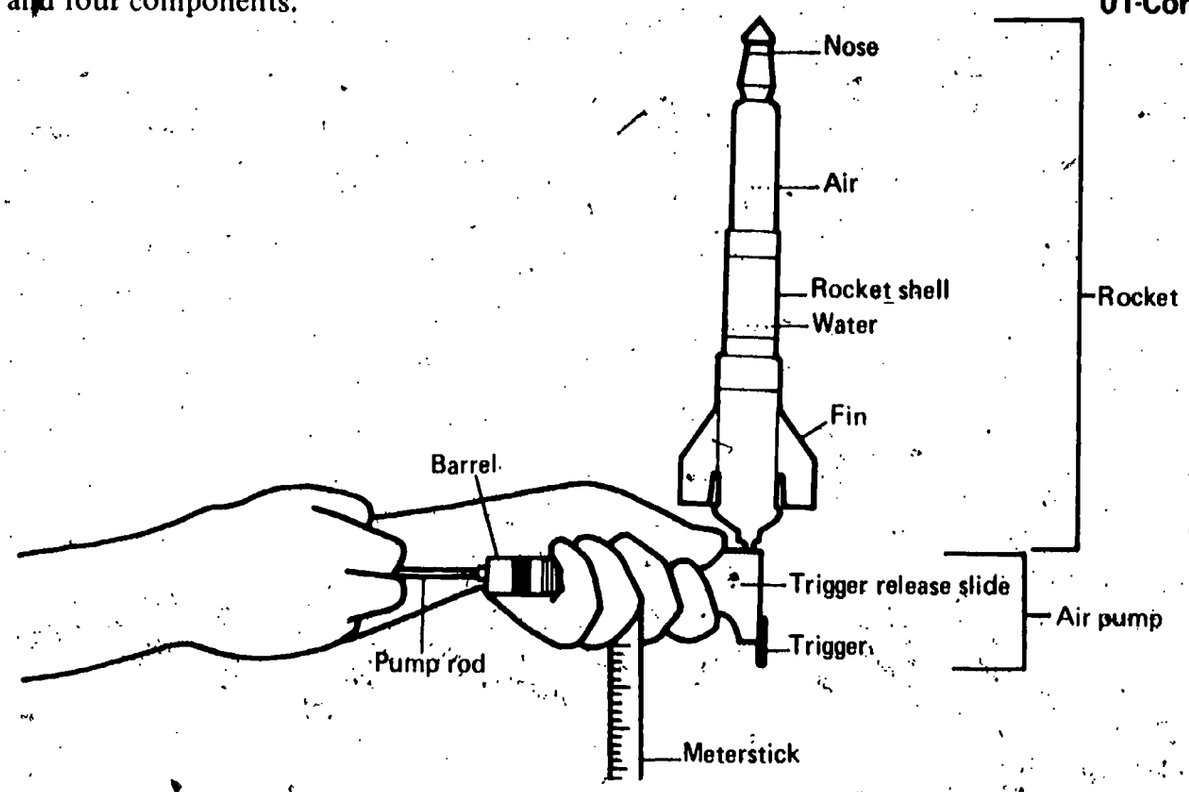
WU 01-Core-8A

One variable that might affect the performance of the water rocket you used in the activities is the weight of the empty rocket. Design a procedure you could use to investigate the effect of this variable.

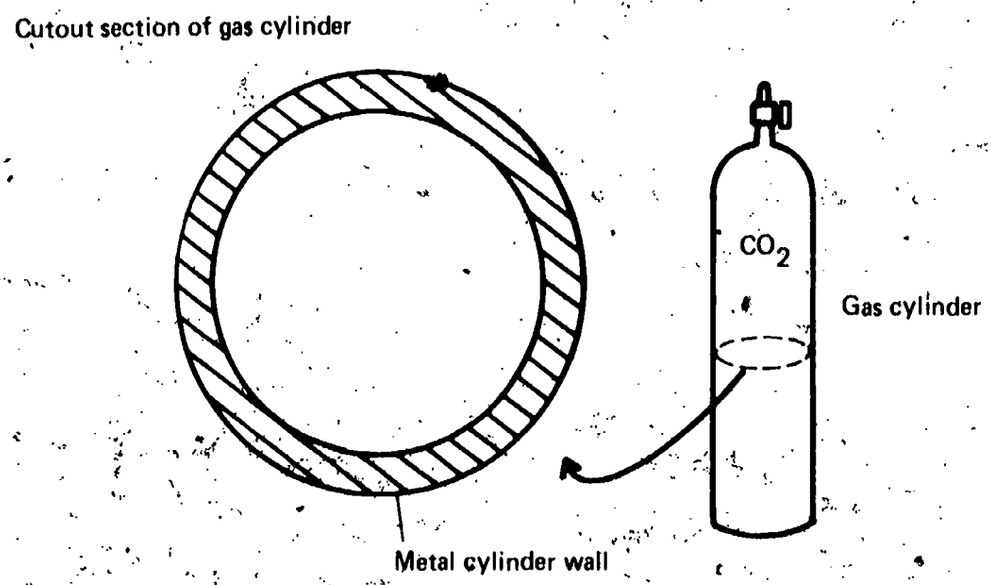
WU 01-Core-9A

What are the two variables that affect the performance of the water rocket you used in class activities?

Suppose you have the rocket shown below ready to launch. Identify one system, two subsystems, and four components. **WU 01-Core-10A**

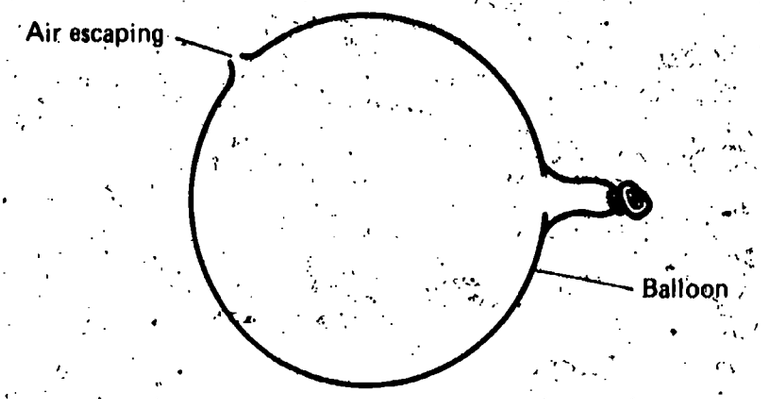


The gas cylinder shown below is filled with carbon dioxide gas under pressure. The diagram also shows a cutout section of the container. Copy the cutout section onto your answer sheet. Draw arrows to show the force (the pressure) that the carbon dioxide exerts on the inside of the container walls. **WU 01-Core-11A**



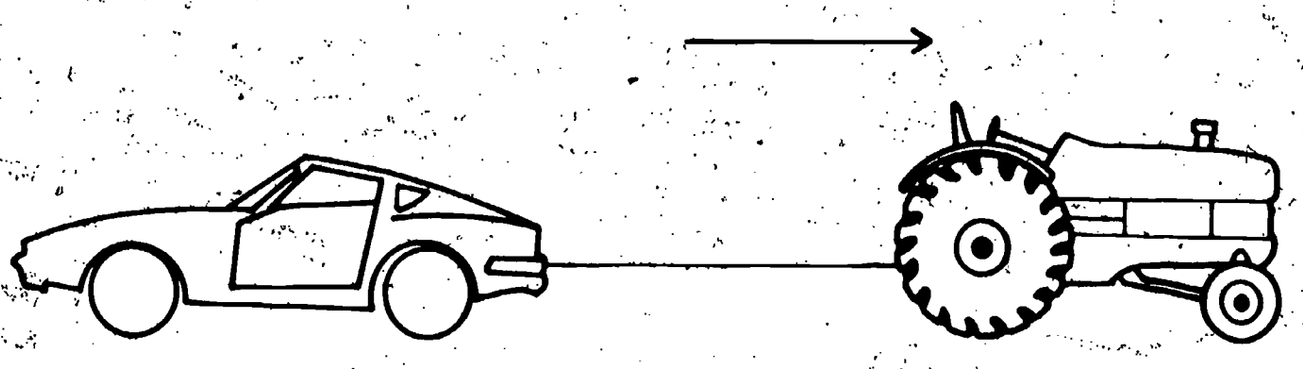
WU 01-Core-12A

Shown in the diagram below is a balloon with air escaping through a hole in its side. Copy the diagram onto your answer sheet, and draw an arrow to show the direction of the unbalanced force acting on the balloon.



WU 01-Core-13A

Cyrus has a toy tractor and a toy car, both operated by batteries. When he hooks them up as shown in the diagram below, they each exert a force in opposite directions. However, the toys move in the direction shown by the arrow. Therefore, an unbalanced force is acting, since the tractor pulls the car backwards. How could this unbalanced force be measured?

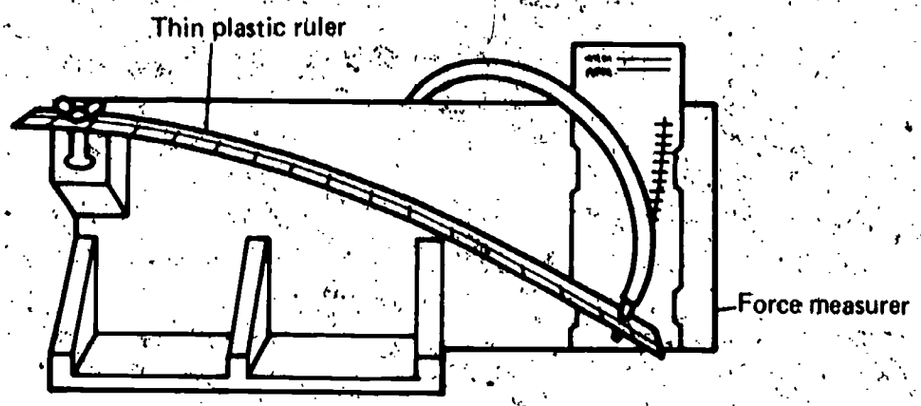


WU 01-Core-14A

Suppose you wanted to measure the initial thrust, or force, of your water rocket. Describe a method that you might use to measure this thrust.

You made your force measurer more sensitive when you used a thin plastic ruler, as shown below. Suppose you wanted to compare your results with your classmates' results. WU 01-Core-15A

1. What would have to be true of all the rulers?
2. Would your classmates have to use the same units to mark their scales?
3. Explain your answer to question 2.



Gerry wanted to find out what effect the speed at which water left a jet had on the unbalanced force. He wanted to keep the rate of flow the same and change only the speed. In the storeroom, he found some water jets that had different-sized openings. Describe a plan that Gerry could carry out to measure the effect on the unbalanced force of changing the speed at which water leaves a jet. WU 01-Core-16A

1. Will a rocket produce a greater unbalanced force when it is in the near vacuum of outer space or when it is still in the atmosphere? WU 01-Core-17A
2. Explain your answer.

You studied a simple rocket system rather than a complex Saturn rocket system. Give two reasons why experiments are performed on simplified systems rather than on more complex systems. WU 01-Core-18A

Your teacher will observe you for this check when he can. WU 01-Core-19A

Your teacher will observe you for this check when he can. WU 01-Core-20A

Your teacher will observe you for this check when he can. WU 01-Core-21A

Your teacher will observe you for this check when he can. WU 01-Core-22A

WU 01-Core-23A	Your teacher will observe you for this check when he can.
WU 01-Exc 2-1-1A	State an operational definition of *force*.
WU 01-Exc 2-1-2A	Give an operational definition of *unbalanced force*.

Hank has carved a rocket out of some balsa wood. He wants to buy a small rocket engine to make it fly. Since he is short of cash, he wants the smallest engine that will launch his rocket. The rocket without the engine or fuel weighs 0.8 newtons. His catalog of engines gives the following information.

WU 02-Core-1A

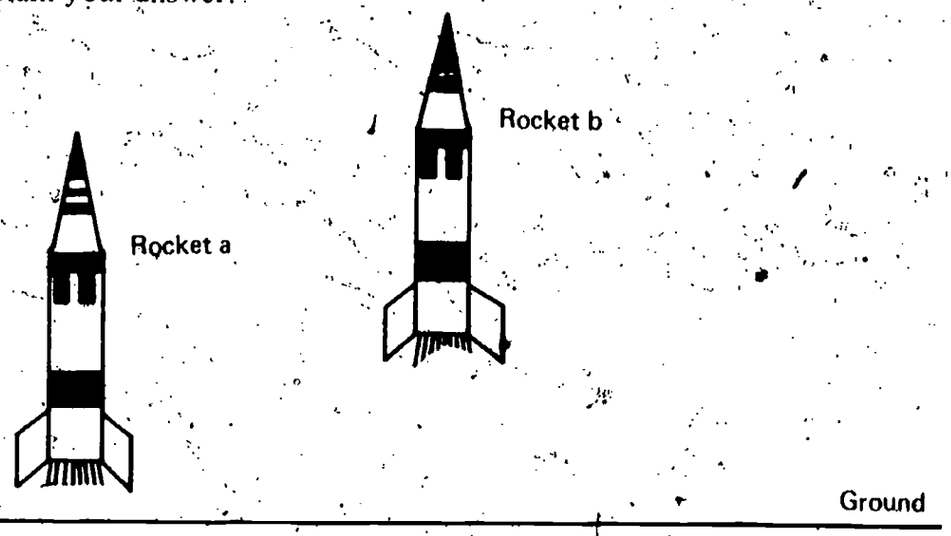
ENGINE MODEL	TOTAL WEIGHT OF ENGINE AND FUEL (in N)	THRUST (in N)
a	0.1	0.4
b	0.2	0.8
c	0.3	1.1
d	0.4	1.5
e	0.5	2.0

1. Which is the smallest rocket engine that will allow his rocket to lift off?
2. Explain the reason for your choice.

Identical rockets a and b shown below, lifted off the launch pad at the same time.

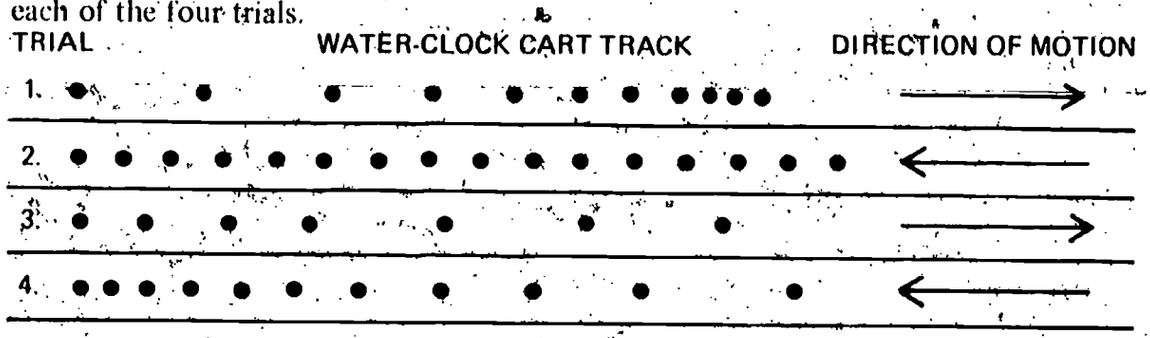
WU 02-Core-2A

1. Which rocket has had the greater unbalanced force acting on it?
2. Explain your answer.



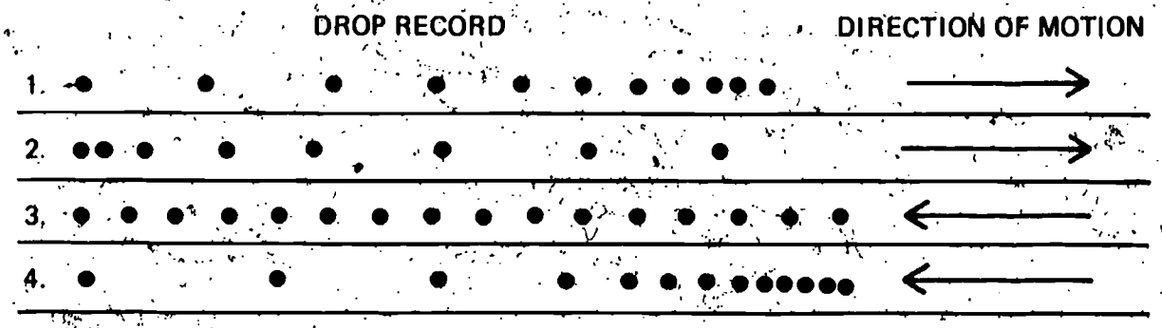
The diagram below represents the water drops left by a moving water-clock cart during four trials. The arrow shows the direction of motion of the cart for each trial. Indicate whether the cart's speed increases, decreases, or remains constant during each of the four trials.

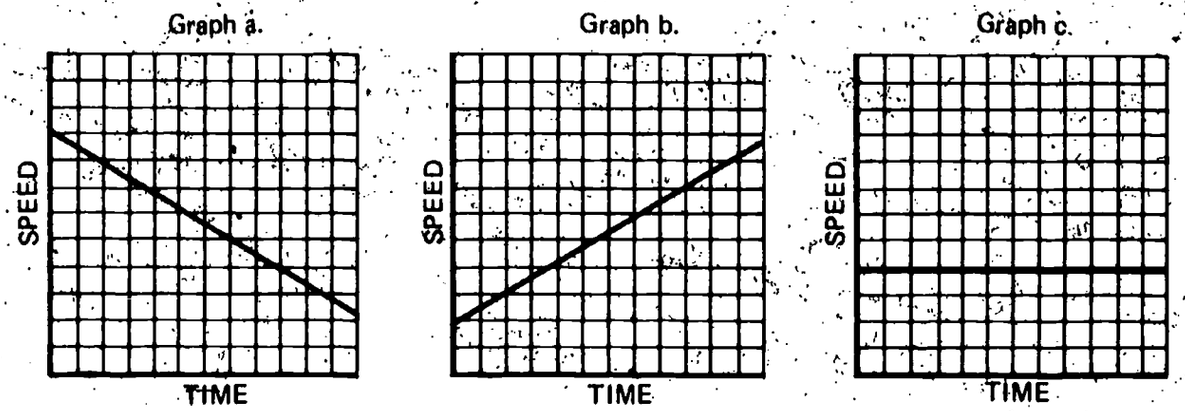
WU 02-Core-3A



WU 02-Core-4A

The graphs below show the change in speed, if any, of a water-clock cart. On your answer sheet after the number of each water-clock cart drop record shown below, write the letter of the graph that best represents the speed of the cart.





WU 02-Core-5A

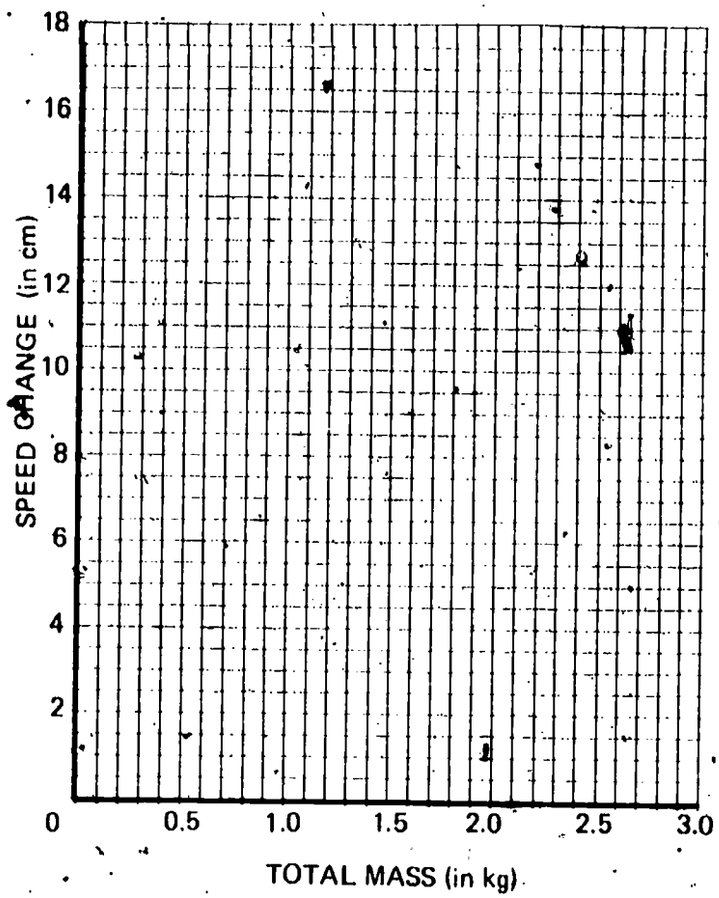
Ed has two water-clock carts. The red one has a mass of 5 kg. The blue one has a mass of 2.5 kg. Using his force measurer, Ed applies the same force to each cart.

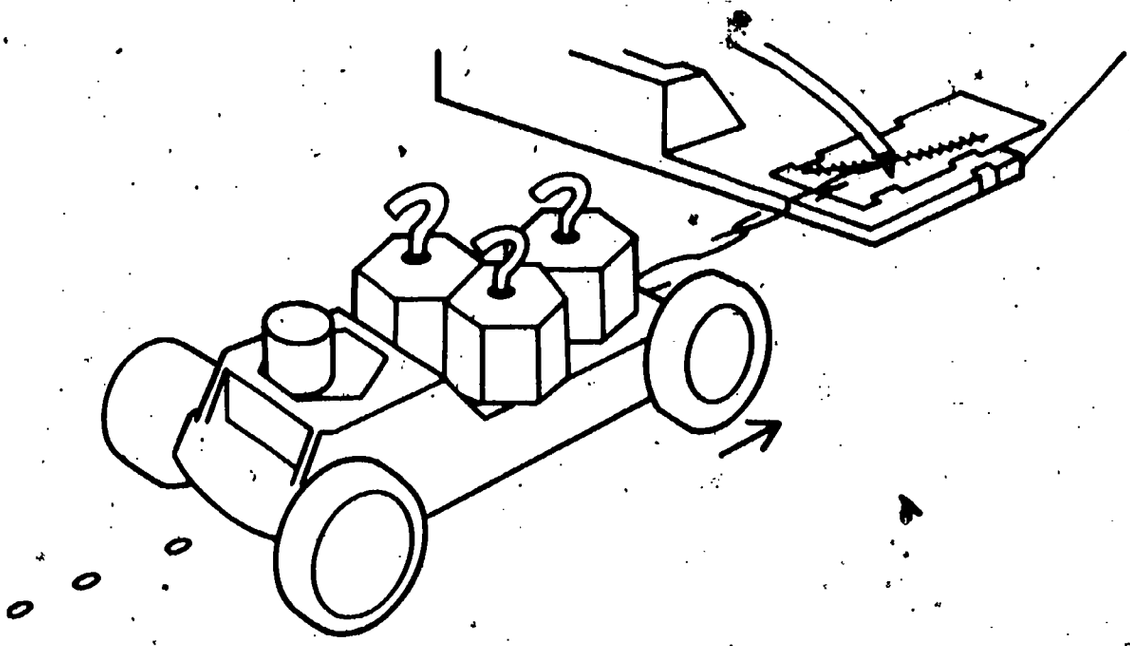
1. Which cart, the red or the blue, will speed up more quickly?
2. Explain your answer.

From your teacher, get a copy of the labeled grid below or a piece of grid paper and label the axes as shown.

Marion measured the distance traveled by her cart over five equal time intervals while she exerted a force of 0.2 N. She changed the mass of her cart for each of the five trials. Her data are shown below. On your labeled grid, draw a graph of her data.

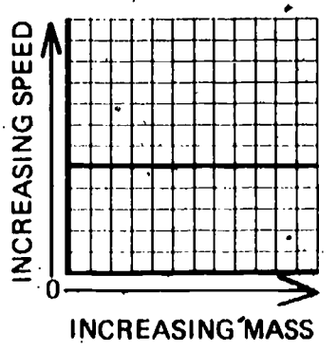
TOTAL MASS (in kg)	DISTANCE CHANGE (in cm)
2.5	3
2.0	4
1.5	5
1.0	8
0.5	16



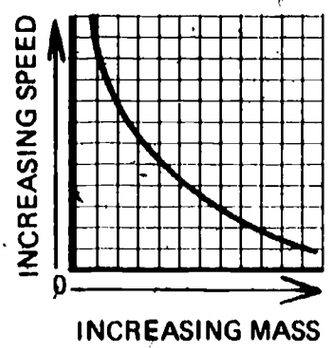


Suppose that the force acting on the water cart shown above was a constant 0.2 N for each trial and the mass on the cart was varied. Select the graph below which best shows the relationship between the mass of the cart and its load and the speed of the cart.

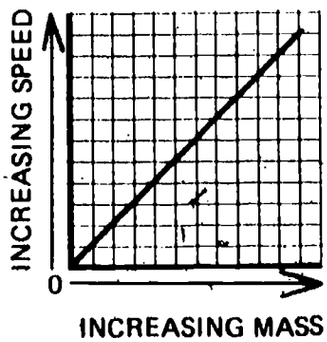
Graph a.



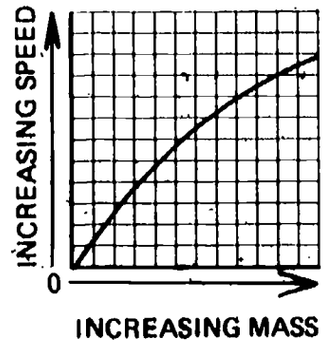
Graph b.



Graph c.



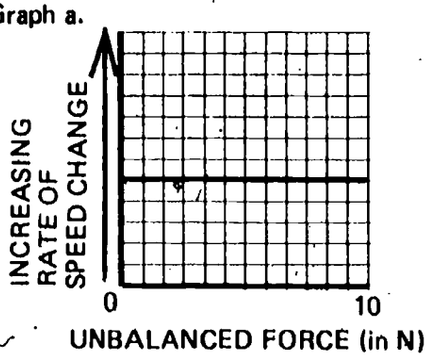
Graph d.



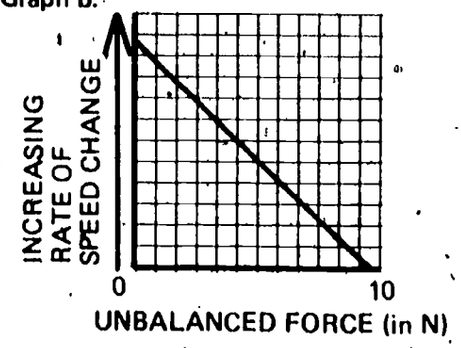
If you used your force measurer to apply different forces to a water-clock cart, the speed would change at different rates. Select the graph below that best shows how the rate at which speed changes varies as the force applied is changed.

WU 02-Core-8A

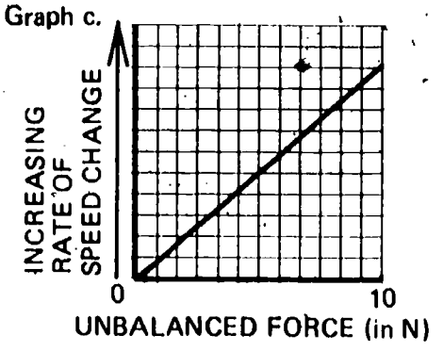
Graph a.



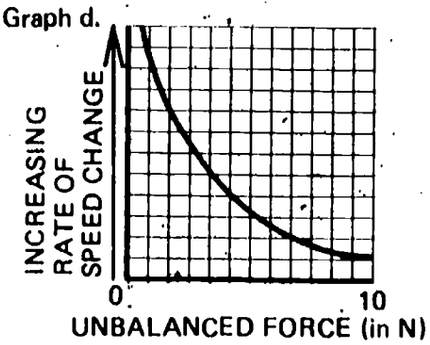
Graph b.



Graph c.



Graph d.



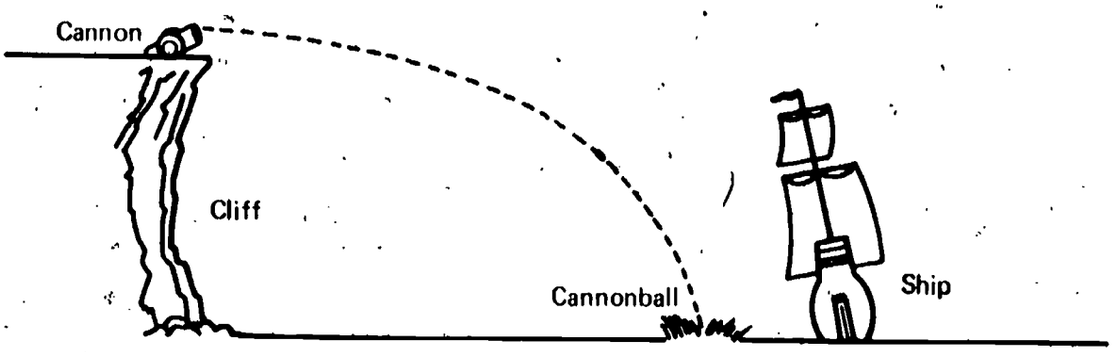
Two identical rockets which exert the same launching force were fired from two identical launching pads. Rocket a was launched with a force that was exerted for 60 seconds. Rocket b was launched with the force exerted for only 30 seconds.

WU 02-Core-9A

1. Will rocket a or rocket b reach the greater speed?
2. Explain your answer.

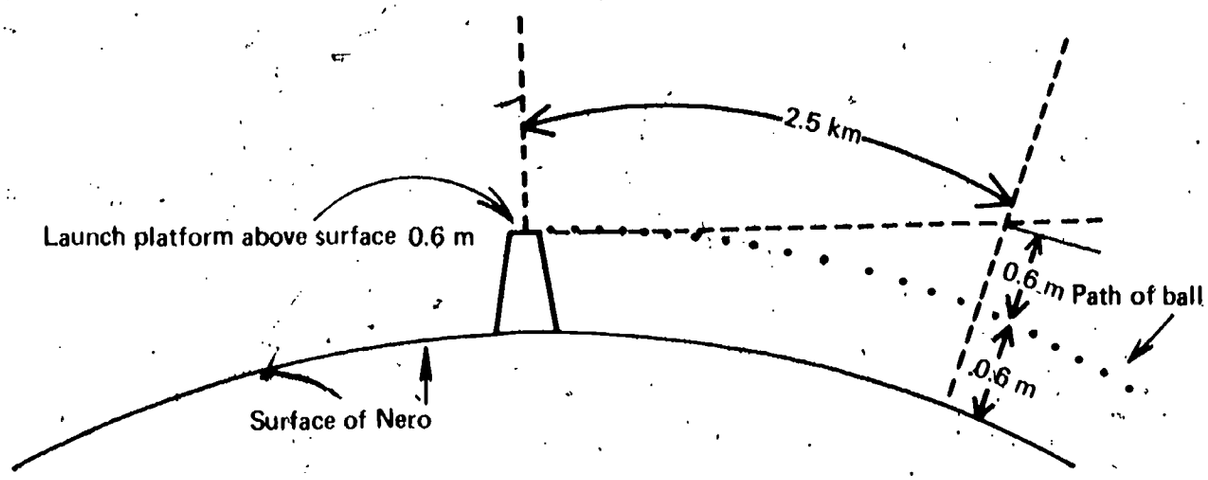
Suppose you were in command of a cannon at the edge of a cliff. The cannon cannot be moved or tilted up and down. It can only fire straight ahead. During an attack, you fire on an enemy ship. The first cannonball drops short of the ship, as shown below.

WU 02-Core-10A



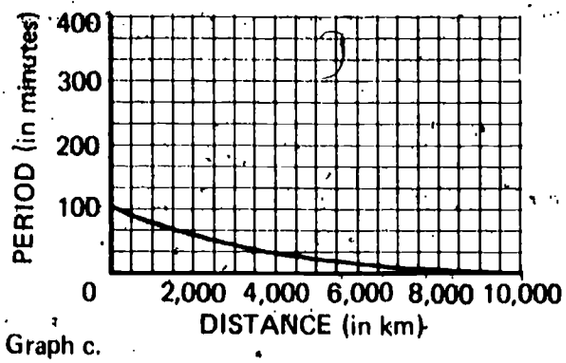
1. What can you do to increase the firing range of your cannon?
2. Explain why this would have the desired effect.

WU 02-Core-11A	In the activity in which you investigated the effect of the sideward force on the fall time of a ball, one of the balls always fell straight down. What was the purpose of using this ball that always fell straight down?
WU 02-Core-12A	Frank clamped his BB gun to a tree so that it would not move. He sighted down the barrel to make sure the BB would start off level. At the same time as Frank fired his gun, Jim dropped a stone from the same height as the gun barrel. 1. If the ground was flat, would the BB or the stone hit the ground first? 2. Explain your answer.
WU 02-Core-13A	An object dropped near the surface of the planet Nero falls 0.6 meters in 1.0 seconds. Use this information and the diagram below to determine the orbiting speed of a satellite near Nero's surface.

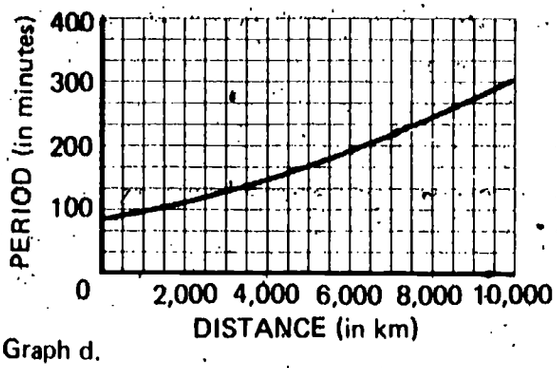


Select the graph below that best shows how the period of a satellite changes as its distance from the earth increases. **WU 02-Core-14A**

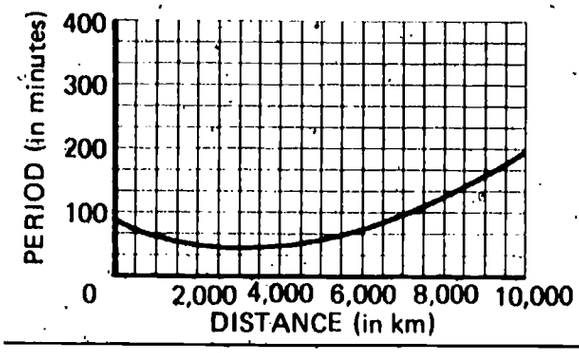
Graph a.



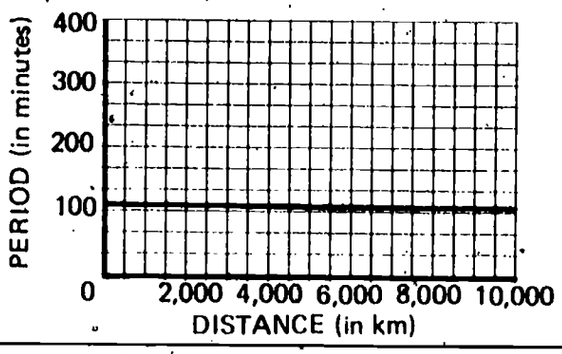
Graph b.



Graph c.

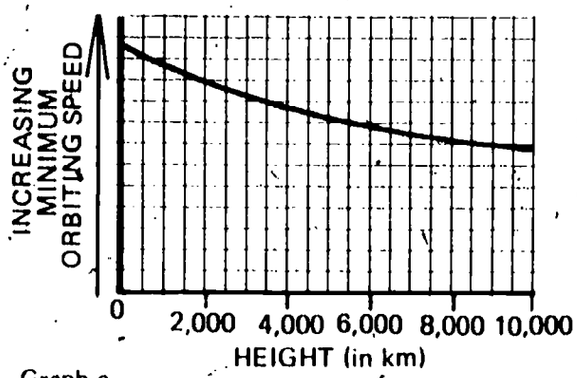


Graph d.

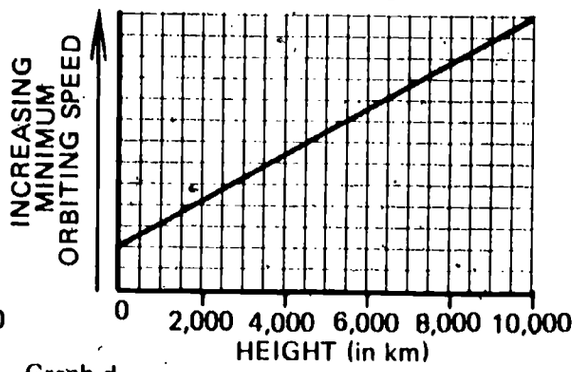


Select the graph below that best shows how the minimum orbiting speed of a satellite changes as the satellite gets farther from the earth's surface. **WU 02-Core-15A**

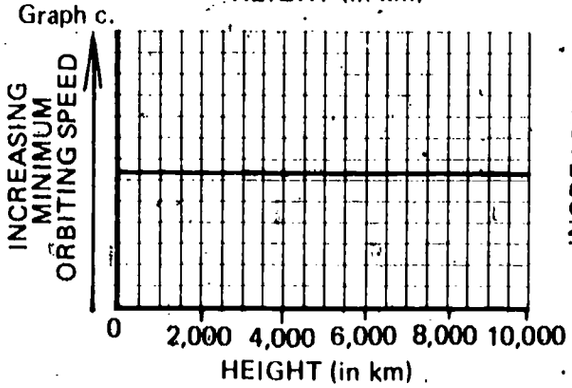
Graph a.



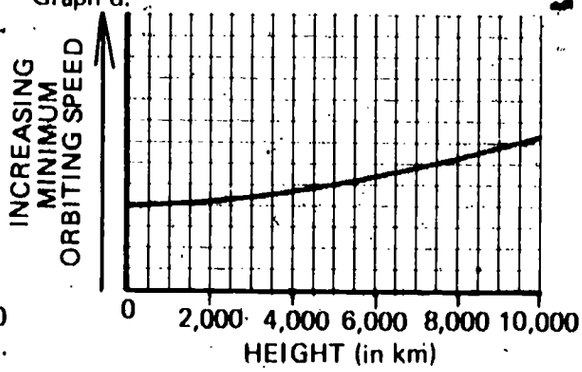
Graph b.



Graph c.



Graph d.

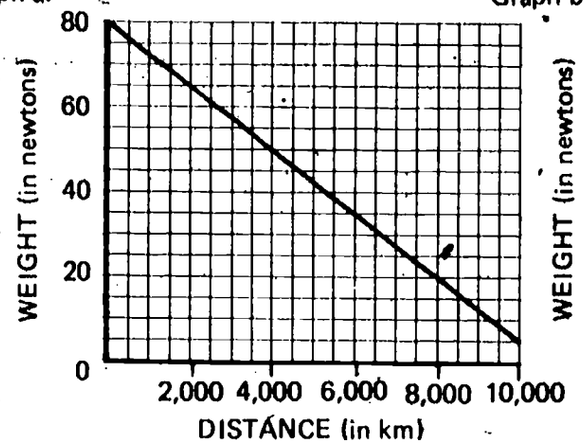


What are two forces that slow down a rocket that is leaving the earth? **WU 02-Core-16A**

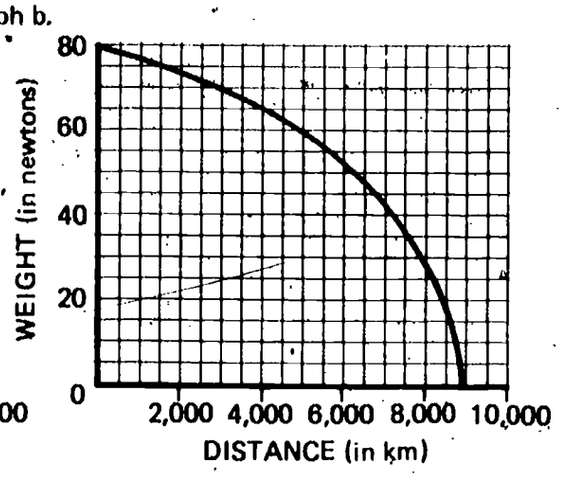
WU 02-Core-17A

Select the graph below that best shows how the weight of an object changes with its distance above the earth's surface.

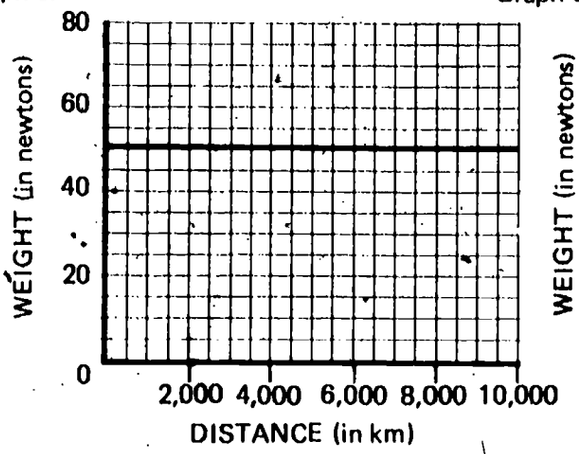
Graph a.



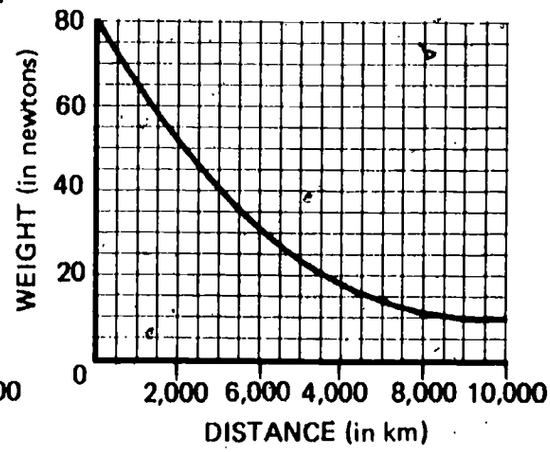
Graph b.



Graph c.



Graph d.



WU 02-Core-18A

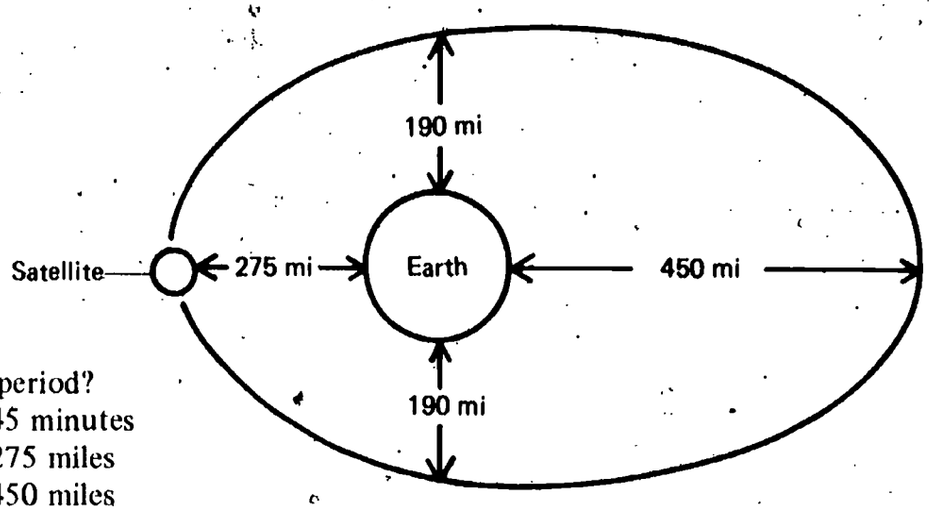
Suppose that a gravity-measuring satellite was launched two months ago from the Space Center.

1. At what distance from the earth should the satellite signal that the earth's force of gravity is zero?
2. Explain your answer.

WU 02-Core-19A

What is meant by the term *period* of a satellite?

A satellite eight feet in diameter rotates on its axis once every 45 minutes and orbits the earth once every 100 minutes as shown below. **WU 02-Core-20A**

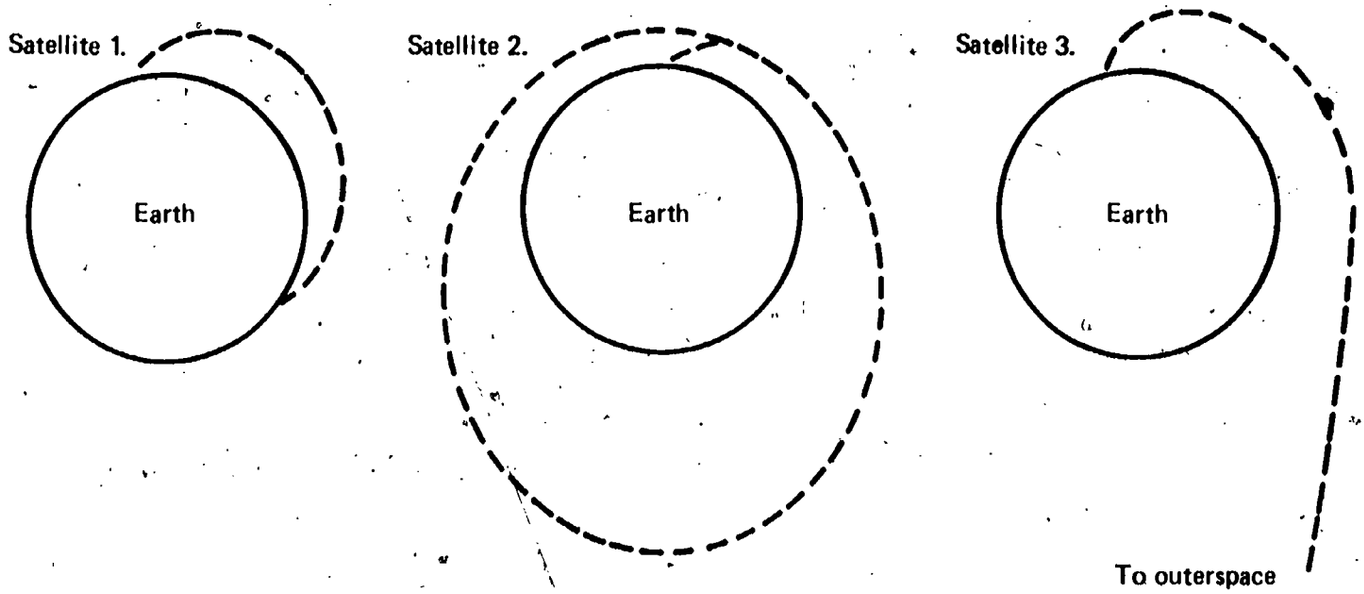


What is its period?

a. 45 minutes
b. 275 miles
c. 450 miles
d. 190 miles
e. 100 minutes

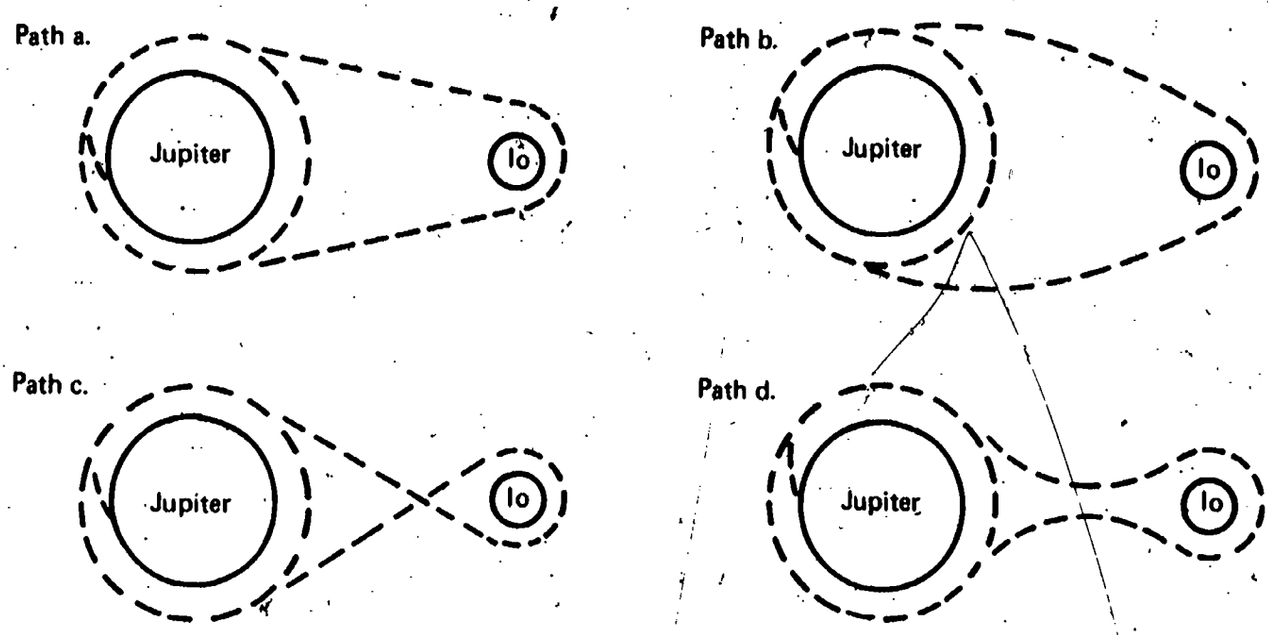
For each of the satellites whose paths are shown below, select the statement that best describes its speed. Write the number of the satellite on your paper and after it the letter of the matching statement. **WU 02-Core-21A**

a. Slightly greater than the speed necessary for a circular orbit
b. Less than the speed necessary for a circular orbit
c. Equal to the speed necessary for a circular orbit
d. Much greater than the speed necessary for a circular orbit



WU 02-Core-22A

Several possible paths for a rocket flight from Jupiter to its moon Io and back to Jupiter are shown below. Select the diagram which shows the free-return path.



WU 02-Core-23A

Suppose that a rocket is traveling from the earth to the moon.

1. Will the rocket have to speed up, slow down, or maintain the same speed if it is going to orbit the moon?
2. Explain your answer.

WU 02-Core-24A

Why does a spacecraft require a heat shield?

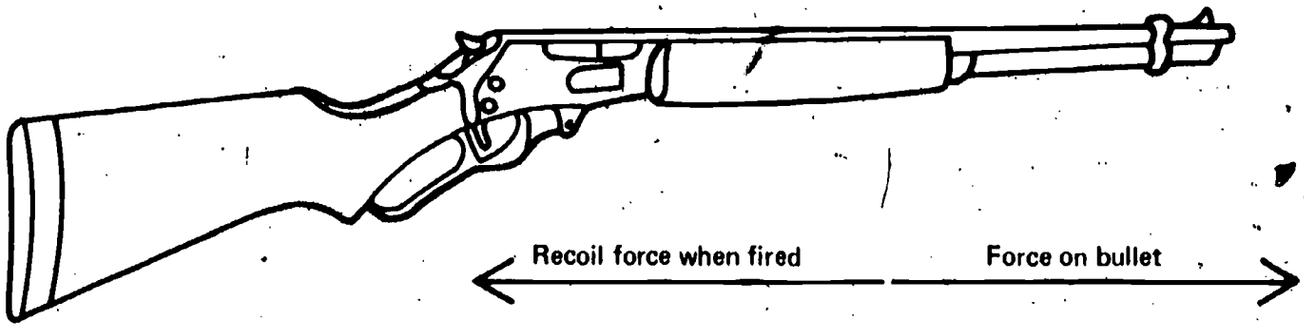
WU 02-Core-25A

Spacecraft returning to the earth can be slowed down by firing retro-rockets.

1. What else causes a spacecraft to slow down when it nears the earth but before the parachutes open?
2. Explain how this causes the spacecraft to slow down.

WU 02-Exc 3-1-1A

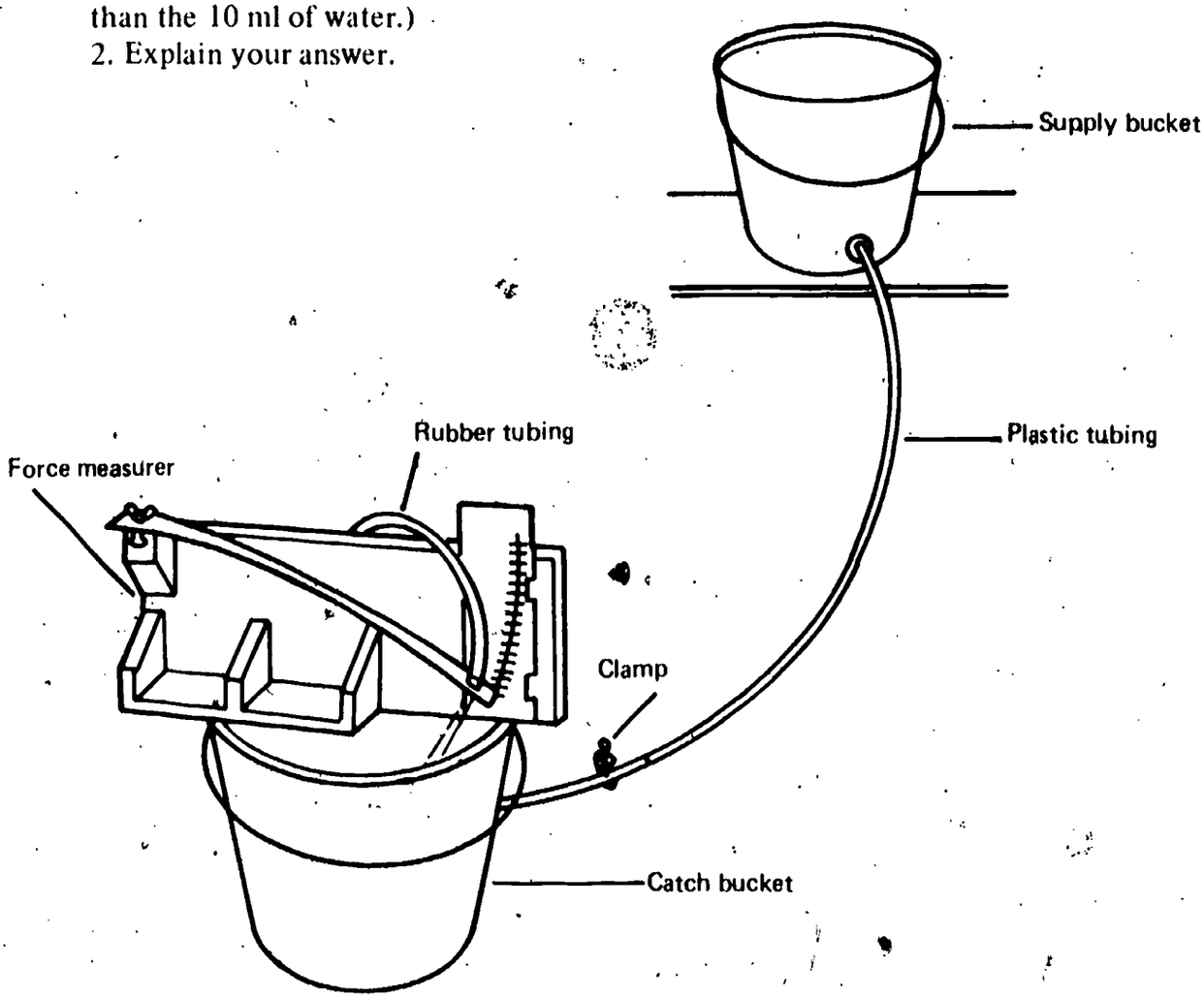
If you have ever fired a large gun, you know that the gun kicks backward when it is fired. Explain why there is this backward force on the gun when the explosion produces equal forces forward and backward. See the illustration on the next page.



Jim set up the equipment shown below. He found that when he used water and a flow rate of 10 ml per second, the force from the jet was 6 units. Suppose he now repeated the experiment, using alcohol and the same flow rate of 10 ml per second.

WU
02-Exc 3-1-2A

1. When Jim used alcohol, would his force measurement be more than 6 units, less than 6 units, or exactly 6 units? (Note that 10 ml of alcohol weighs less than the 10 ml of water.)
2. Explain your answer.



WU 02-Exc 3-2-1A	A small rocket engine ejects 0.05 kg of mass each second. This mass is thrown out from the rocket at 900 m per second. What is the thrust (force) produced by this engine?
WU 02-Exc 3-2-2A	What are two ways that a rocket engineer can increase the thrust (force) produced by a rocket engine?
WU 02-Exc 3-2-3A	Many rockets burn their fuel in two or three stages. Why are rockets built to burn their fuel in several stages?
WU 02-Exc 4-1-1A	In the past, many incorrect ideas were accepted for long periods of time. For example, it was believed for hundreds of years that diseases spread from one person to another by foul air. In the last 200 years or so, many of our ideas about how diseases spread have changed. Select the best reason why incorrect ideas such as this one were able to last so long. a. People are smarter now than they were then. b. The first schools started about 200 years ago. c. The old ideas were not tested by performing controlled experiments. d. The greatest thinkers are alive today. e. The old ideas explained the experimental observations just as well as the modern ones.
WU 02-Exc 4-1-2A	Select any of the following variables that affect the period of a pendulum. a. Weight of the ball b. Length of the pendulum c. Timing device used d. Time of day
WU 02-Exc 4-2-1A	Scientists often devise models to describe what they see. Many of these models use mathematics. Why is a model which is stated in terms of mathematical formulas or equations likely to be more helpful to a scientist than a model which describes the same things in words?

Suppose that several NASA engineers are planning to put a satellite into orbit around Mars. They want this satellite to remain directly over the same spot on Mars's surface at all times. They have the following information about Mars.

WU
02-Exc 4-3-1A

Time for Mars to revolve around the sun	1.88 earth years
Time for Mars to make one complete rotation on its axis	24.6 earth hours
Diameter of Mars	0.54 of earth's diameter
Force of gravity at Mars's surface	0.40 of earth's gravity

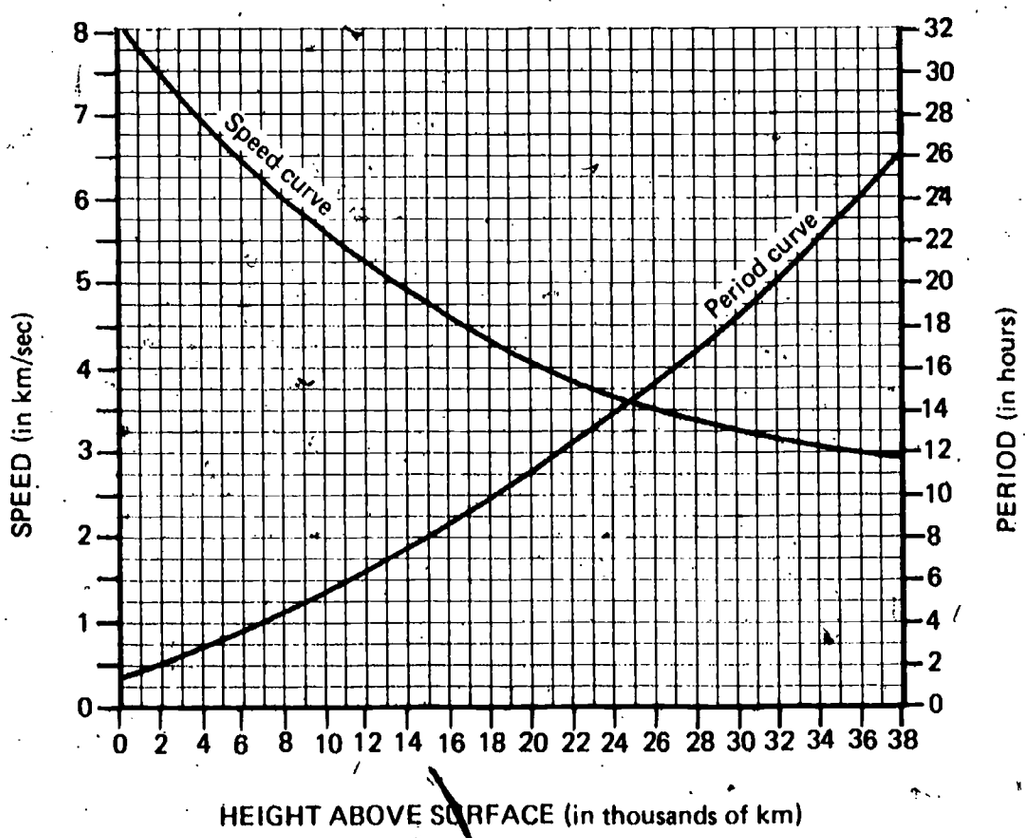
Which of the following is the correct period for this satellite?

a. 0.40 earth gravity units
b. 0.54 earth diameters
c. 24.6 earth hours
d. 1.88 earth years

Use the graph below to determine the following information for a space vehicle with a period of 14 hours.

WU
02-Exc 4-3-2A

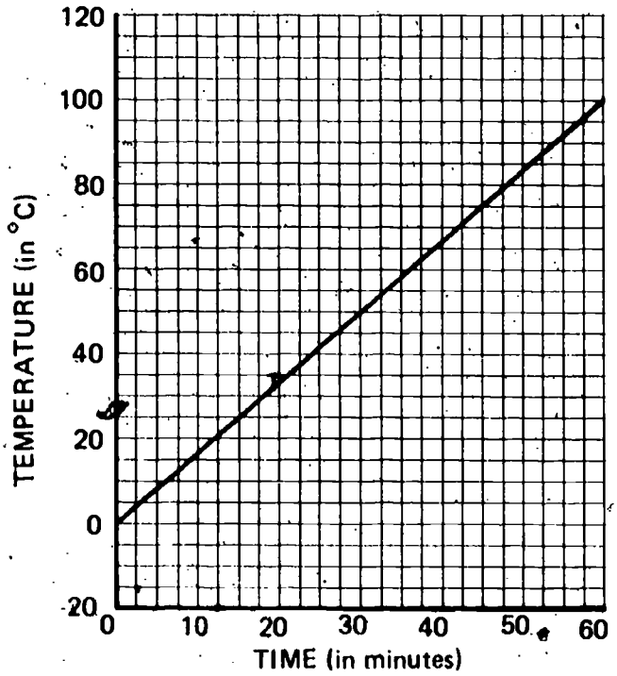
1. Height above the surface
2. Orbital speed



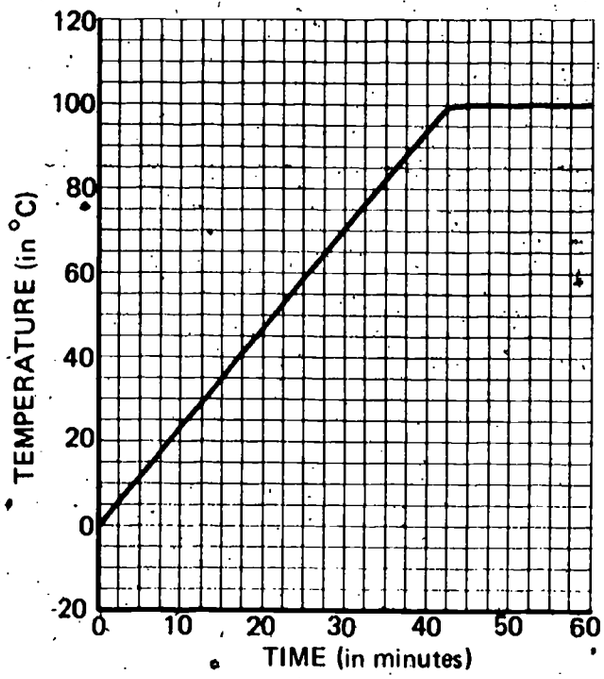
WU
02-Exc 4-4-1A

Suppose that you put a flame under an open container containing ice and continue heating it until all the water has boiled away. Select the graph below that best shows how the temperature would change during the entire heating process. The freezing point of water is 0°C and the boiling point is 100°C.

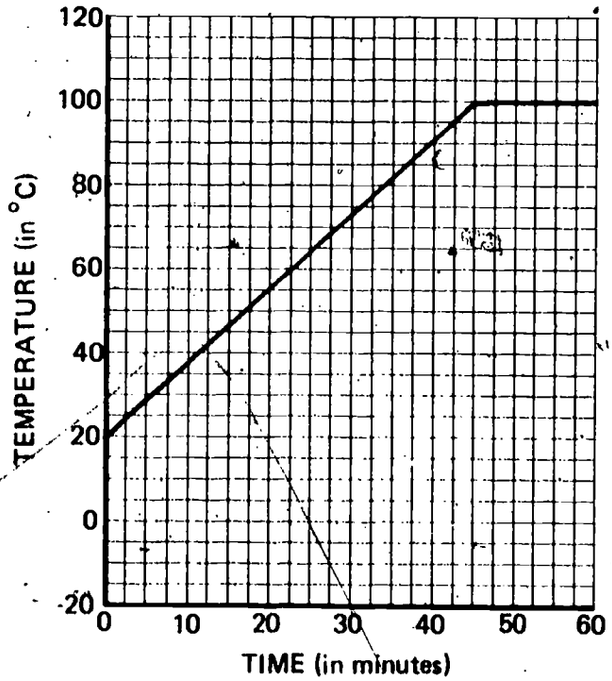
Graph a.



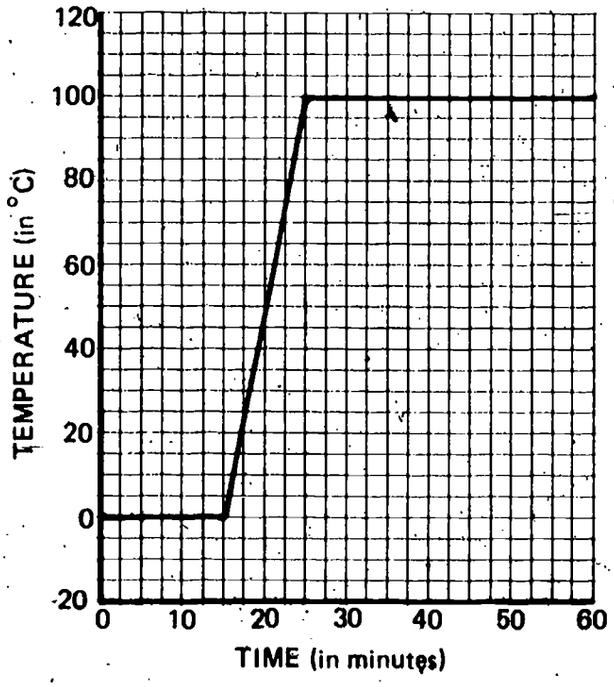
Graph b.



Graph c.



Graph d.

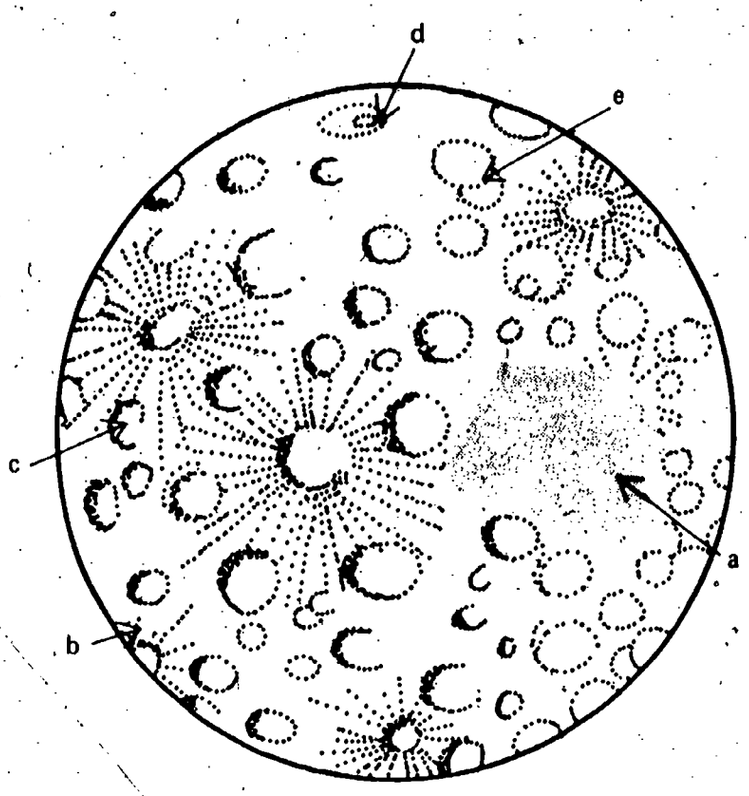


WU
02-Exc 4-4-2A

A great deal of heat is produced by friction when a spacecraft reenters the atmosphere. Explain why the spacecraft does not burn up from the heat generated during its reentry.

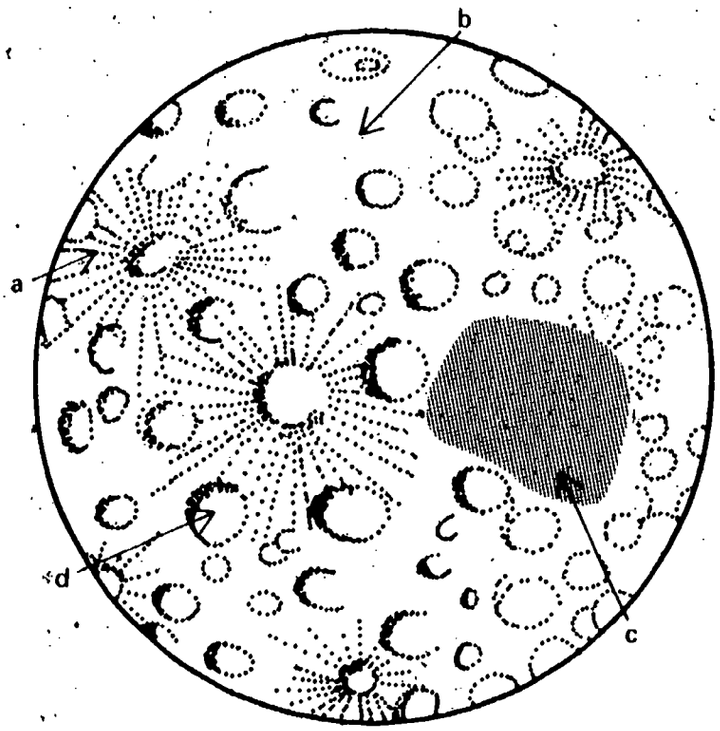
The diagram below shows part of the lunar surface. Identify the mare by writing the letter of the arrow which points to it.

WU 03-Core-1A



The diagram below shows part of the moon's surface. Select the letter of the arrow on the illustration which indicates a ray.

WU 03-Core-2A



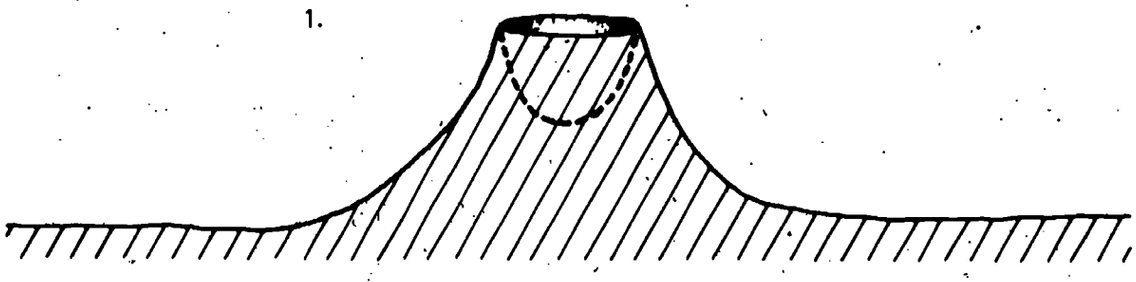
WU 03-Core-3A

Geologists are scientists who study the history and formation of rocks and minerals. They are very much interested in the origin of the moon's rocks. Why are these scientists particularly interested in the origin of rocks on the moon?

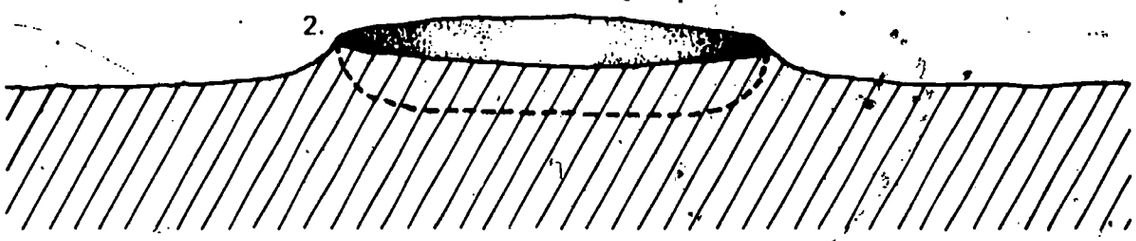
WU 03-Core-4A

The diagrams below show craters that were formed on the earth's surface. The dashed lines show the interiors of the craters. On your answer sheet, write the most probable cause of each of these craters.

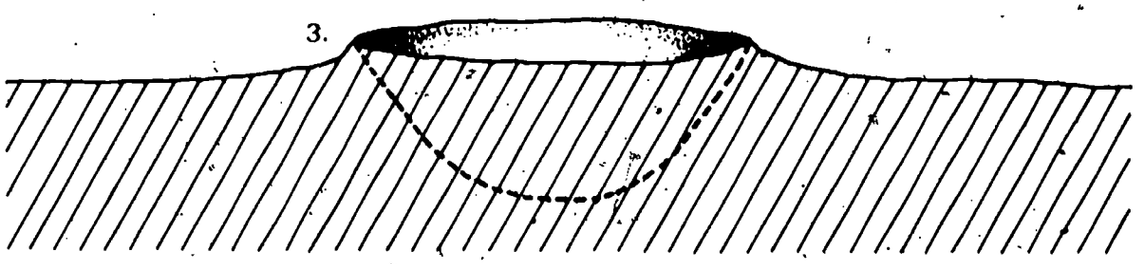
1.



2.



3.



WU 03-Core-5A

What are two variables that determine the size of the crater that is formed by a falling body?

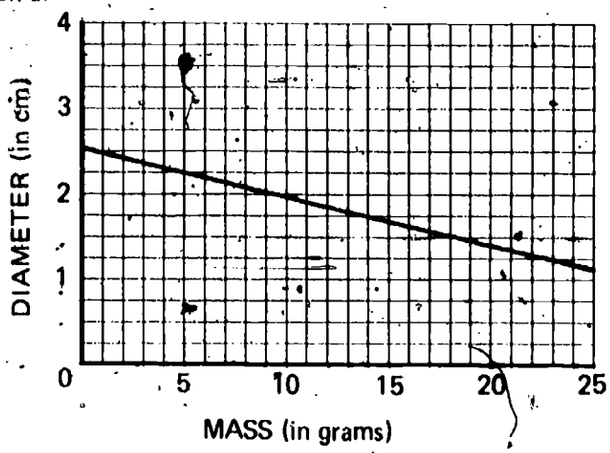
WU 03-Core-6A

Simon, Tina, and their teacher were on the roof of the school. Simon dropped a steel shotput (ball) and Tina dropped a wooden ball of exactly the same size from exactly the same height to the ground.

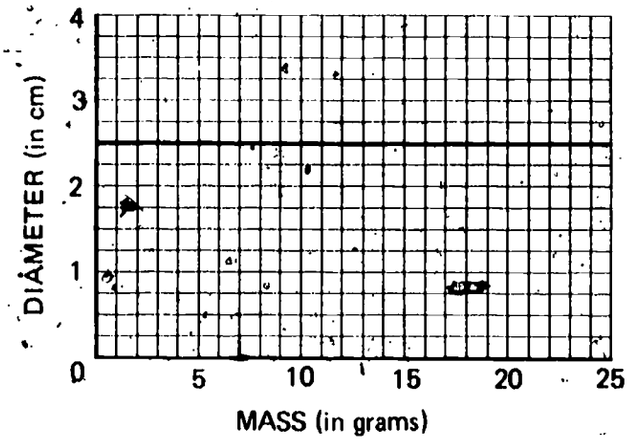
1. Which object was traveling faster when it struck the ground?
2. Explain your answer.

Select the graph that best shows how the diameter of a crater changes when balls of different masses but the same diameter are dropped into sand. **WU 03-Core-7A**

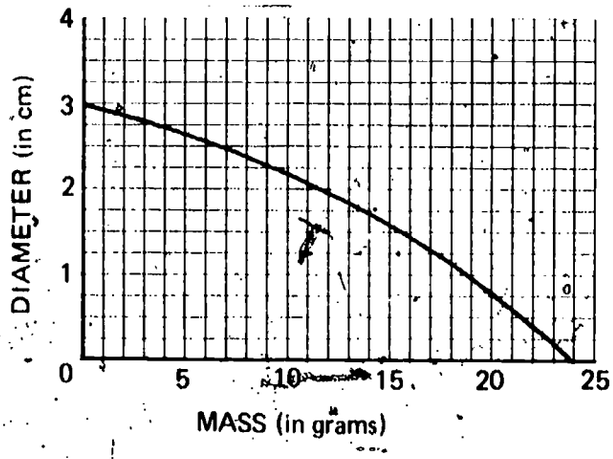
Graph a.



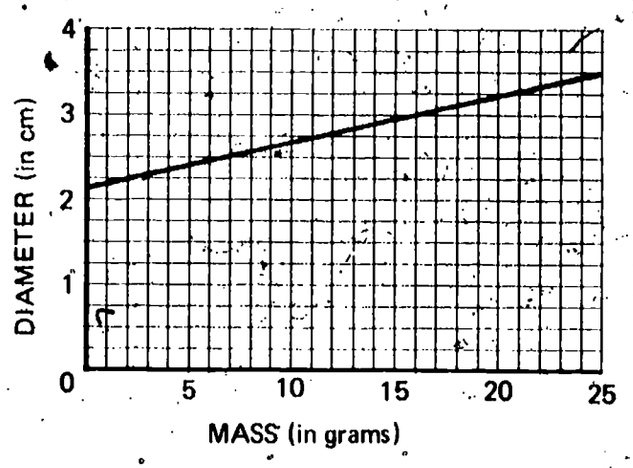
Graph b.



Graph c.



Graph d.

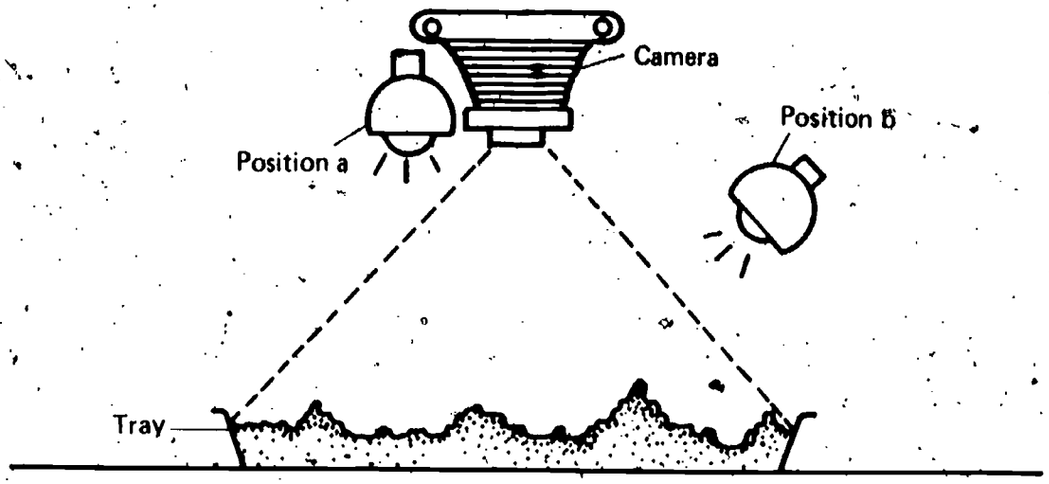


When you dropped balls into sand to form craters, you changed the mass by using different balls. You also changed the distance of fall to give a different impact speed. Why did you change only one of these variables at a time? **WU 03-Core-8A**

Suppose you wanted to investigate the effect of changing the diameter of a falling body on the size of the crater it makes. Describe a plan you could perform to investigate this effect, using a ball and sand. Be sure to include in your description the variables you would vary and those which you would keep the same throughout the investigation. **WU 03-Core-9A**

WU
03-Core-10A

Henry wants to take a photograph of some of the moon craters he has made. He sets up the equipment as shown below.



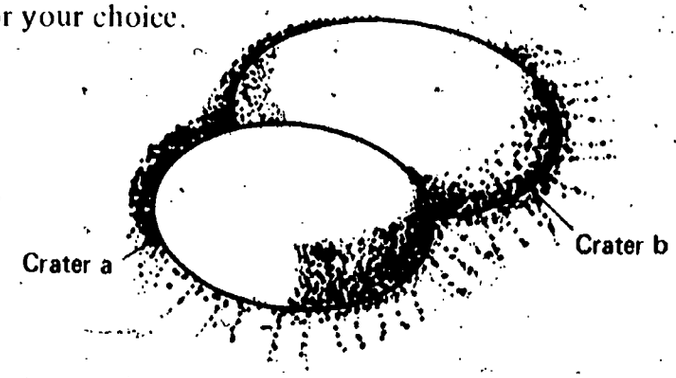
1. If he wants to get the most detail, should he put the light at position a or position b?
2. Explain your answer.

WU
03-Core-11A

There is no rain or wind to cause erosion on the surface of the moon. However, erosion does occur. What causes craters and cones on the moon's surface to erode?

WU
03-Core-12A

1. Which of the moon craters in the diagram below was formed first?
2. Explain the reason for your choice.



WU
03-Core-13A

The sand model of the moon's surface explained the shape and size of craters. Why was this model of the moon's surface changed to a rottenstone-on-top-of-bentonite model?

WU
03-Core-14A

Suppose you were on the moon near a crater that had rays coming from it. You drilled into the surface and examined the rock that you hauled up. Predict how the color of the rock will change as you drill deeper.

In Activity 5-12, you found that sunlight darkens a piece of light-sensitive paper. Which statement below is the best conclusion about the effect of sunlight on the moon's surface which you can draw from that activity? **WU 03-Core-15A**

a. Since sunlight darkens the moon's surface, that surface is made of the same chemicals as the light-sensitive paper.
b. Since sunlight causes some substances to darken, this might explain the moon's surface material being darker than that underneath the surface.
c. Sunlight causes the surface of the moon to darken.
d. Sunlight darkens the surface material on the moon but does not affect the material thrown out from below the surface.

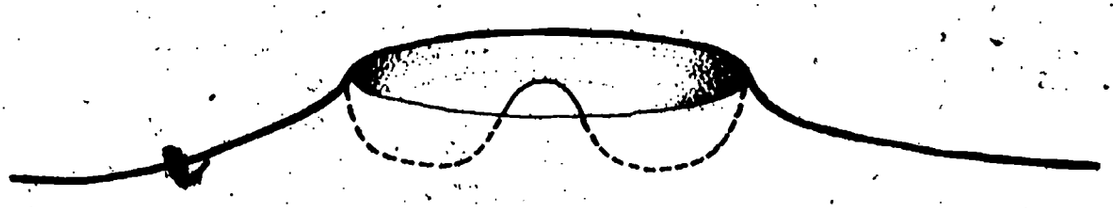
Suppose you were on the surface of the moon and hit a baseball. **WU 03-Core-16A**

1. Would it travel a greater or smaller distance than it would on earth?
2. State two reasons for the difference.

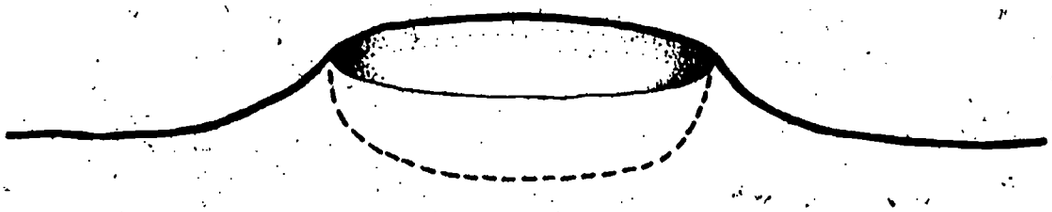
The diagrams below show craters that were formed by the impact of meteors on two places on the moon where the surfaces were identical. The dashed lines show the interiors of the craters. **WU 03-Core-17A**

1. Was the meteor that caused crater A traveling more slowly or more rapidly than the meteor that caused crater B?
2. What evidence do you have for your answer?

Crater A.



Crater B.



You found that when you dropped a drop of water on a layer of bentonite, it formed a crater with a central peak. State three ways in which you can increase the size of your model's central peak during the crater's formation. **WU 03-Core-18A**

WU 03-Core-19A

The sketch below shows a cinder cone on the surface of the moon. What is the most likely cause of this cinder cone?

WU 03-Core-20A

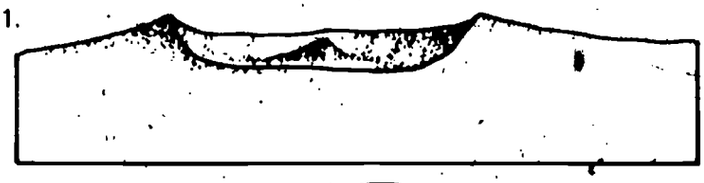
There are dome-shaped mountains on the surface of the moon. State a possible cause for these mountains.

WU 03-Core-21A

The diagrams below show four different features which occur on the moon's surface. After the number of each feature, write the letter of the probable cause of that feature.

Feature

1.



2.

3.

4.

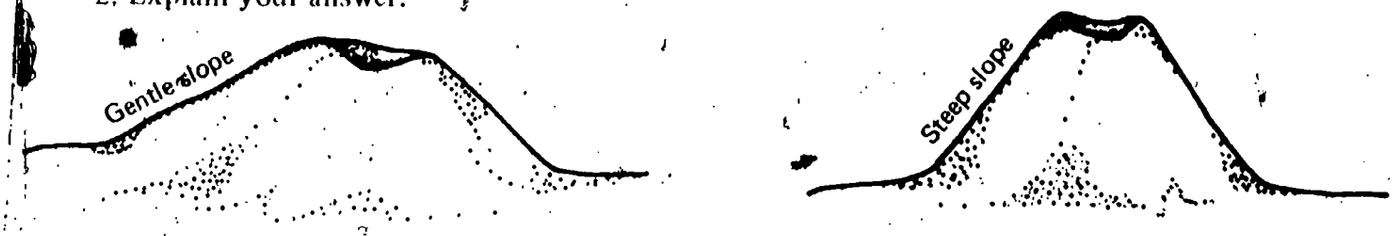
Probable Cause

a. Volcanic eruption
b. High-speed meteor impact
c. Underground magma flow
d. Explosion below the surface
e. Low-speed meteor impact

Suppose a scientist discovered a cinder cone on the moon's surface. Many of its features indicate that the cone was caused by volcanic activity. However, all cinder cones on earth which the scientists have observed have fairly gentle slopes, whereas the cones on the moon have steep slopes, as shown in the diagram below.

WU 03-Core-22A

1. Is this sufficient evidence to throw out the model that volcanic action is responsible for the cones on the moon?
2. Explain your answer.

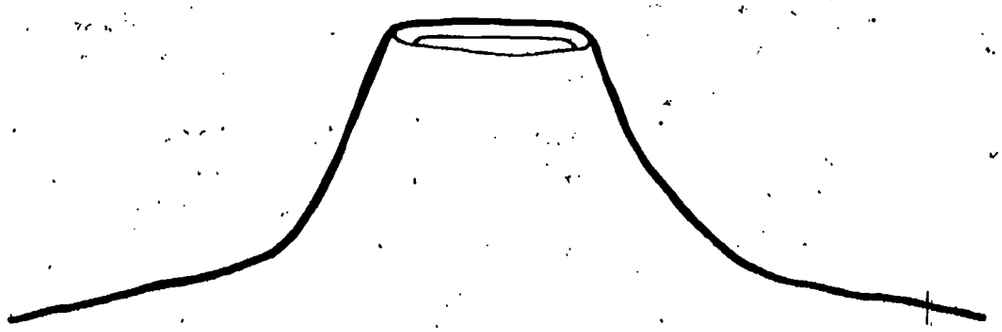


Cinder cone on earth

Cinder cone on moon

Use the diagram below to answer the questions that follow.

WU 03-Core-23A



1. What is the most likely cause for the formation of this cone?
2. What two pieces of evidence from the diagram do you have to support your answer?

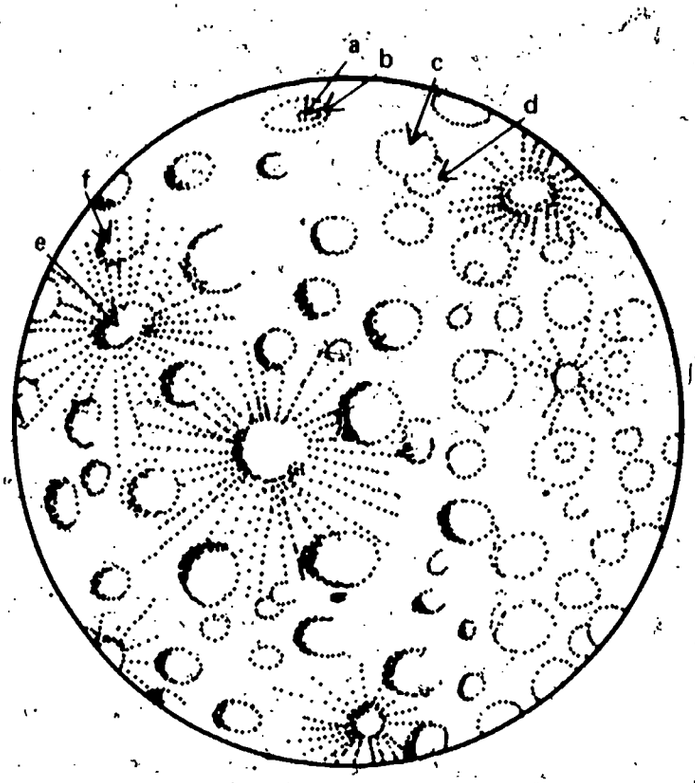
Features on the earth's surface change because of the weathering effects of wind and water. What are three things that may cause the surface of the moon to change?

WU 03-Core-24A

WU
03-Core-25A

Several features are indicated by arrows on the diagram of the moon's surface below.

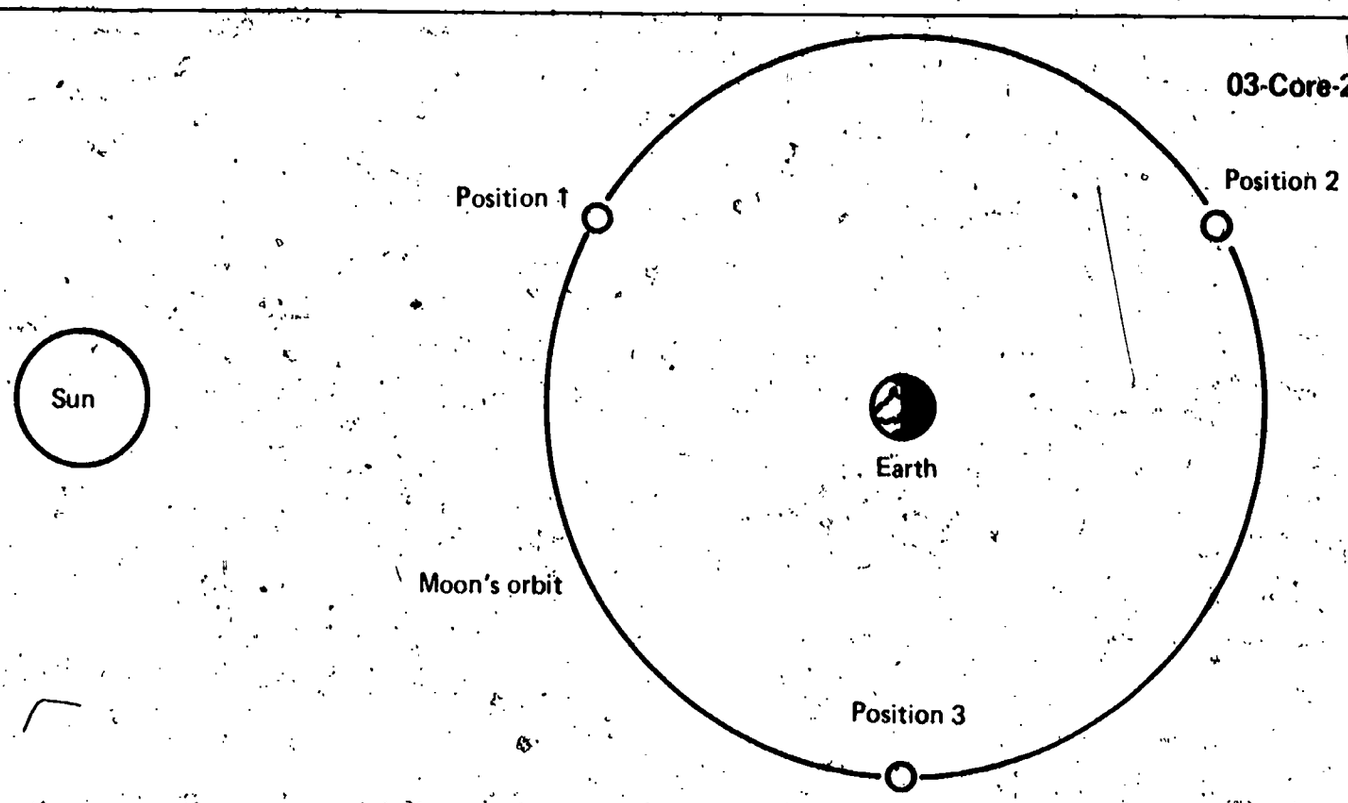
1. Indicate which of the two features in each of the following pairs is probably the older of the two features.
   (1) a or b
   (2) c or d
   (3) e or f
2. For each pair, state why you think the feature you selected is the older feature.



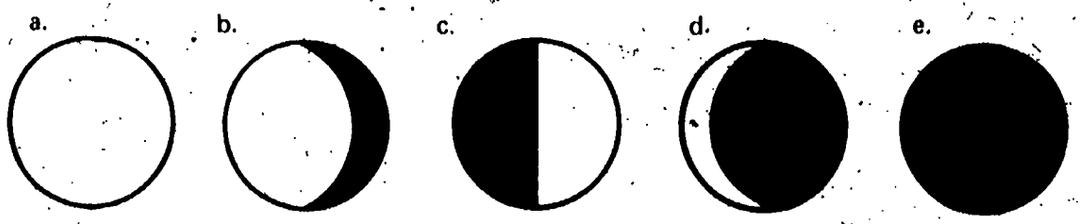
WU
03-Core-26A

Get the materials you need to set up the sun-moon-earth model used in Activity 7-2. Arrange the model so that an observer on the moon sees a full earth.

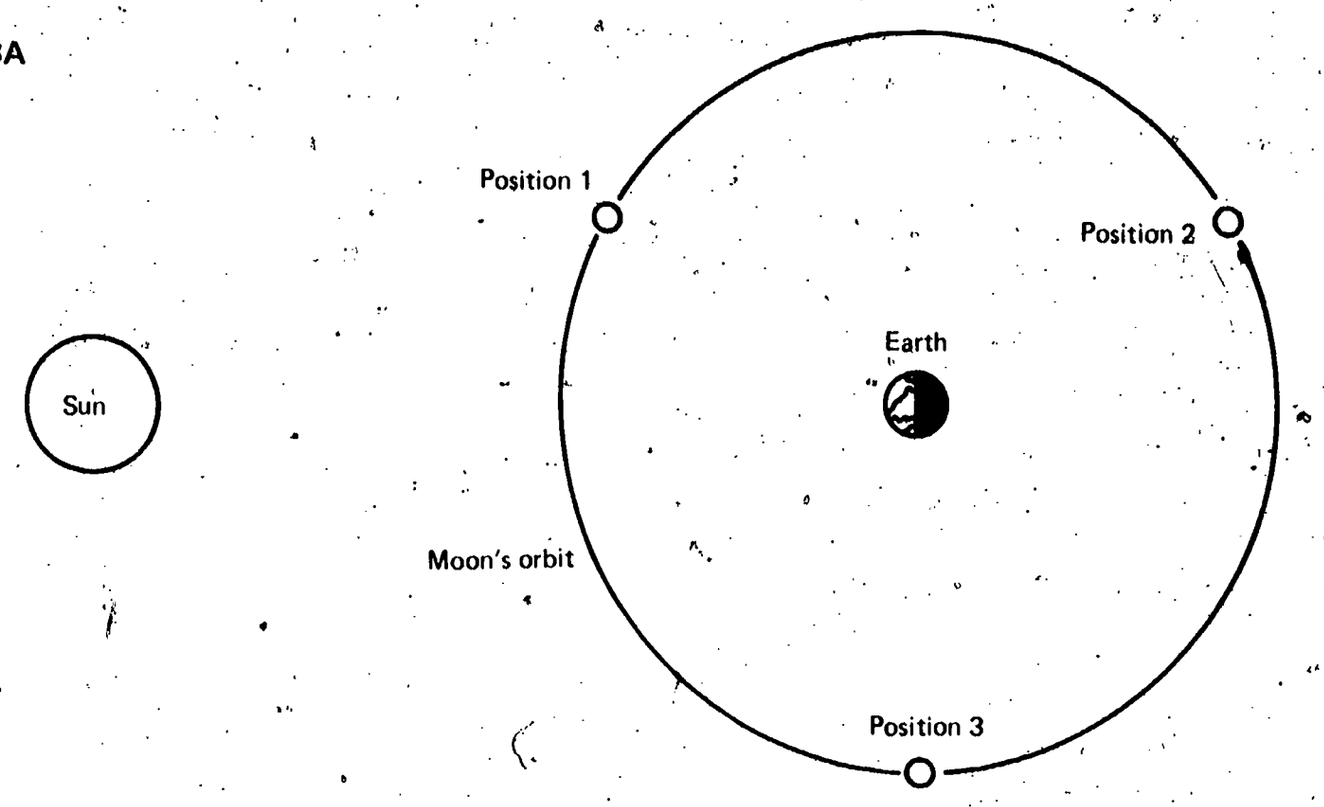
1. What fraction of the earth's surface would an observer on the moon see in a 12-hour period?
2. What fraction of the earth's surface would an observer on the moon see in a 6-hour period?



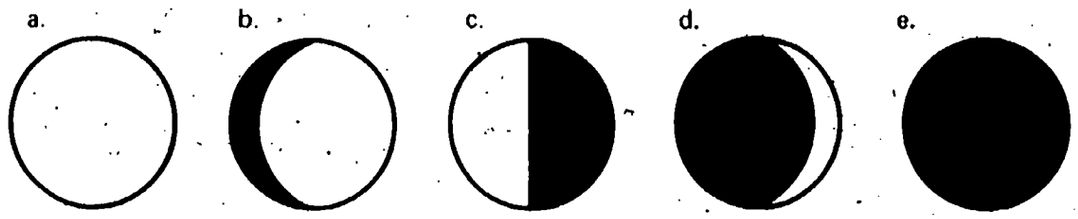
Use the sun-earth-moon model shown above to determine how the moon would appear to an observer on the earth who is facing the moon when the moon is in each of the three positions shown in the model. Write the number of the position and after it the letter of the diagram which shows the most likely appearance of the moon in that position.



WU
03-Core-28A



Study the sun-earth-moon model shown above. Match each of the three positions of the moon with the diagram below which best shows how the earth would appear to an observer on the moon. Write the number of the moon's position and after it the letter of the earth diagram.



WU
03-Core-29A

An astronaut on the surface of the moon notices that the earth appears directly overhead. One week later, he returns to the same location on the moon's surface. Select the answer that best indicates where the astronaut will have to look to see the earth.

a. Directly overhead
b. About halfway between the horizon and overhead
c. Near the horizon
d. Impossible for him to see the earth

The diagram below shows the positions of the sun, the moon, and the earth when there is a new moon. Explain why an observer on the earth sees the surface of the moon as dimly lighted rather than completely dark. **WU 03-Core-30A**

Since the moon revolves around the earth, why is only one side of the moon ever visible from the earth? **WU 03-Core-31A**

What is the period in days of the moon's revolution around the earth? **WU 03-Core-32A**

What is the period in days of the earth's revolution around the sun? **WU 03-Core-33A**

Suppose you weighed an object at the earth's surface and then weighed the same object at the moon's surface. **WU 03-Exc 5-1-1A**

1. Would the object's weight on the moon's surface be more, less, or about the same as its weight on the earth's surface?
2. If it would be more or less, how much more or less would it be?

A life-support system weighs 330 lbs when weighed at the earth's surface. What is its weight on the surface of the moon? Show your work. **WU 03-Exc 5-1-2A**

1. Do the surface features of the far side of the moon differ very much from the surface features of the side of the moon that is visible from the earth? **WU 03-Exc 7-1-1A**
2. If so, describe the differences.